CWT Call Box

Owners Manual

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LEXAN M200 CDMA
CALL BOX
P/N 4421-0176

Appendix A

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CHAPTER 1
General Information and Specifications

1-1 Introduction

Cellular call boxes provide vital communications services on highways, parking areas, bridges, tunnels, and other critical locations. The call box system uses proven digital cellular telephone technology that is cost-effective, flexible, readily installable even in remote or harsh environments, and extremely reliable. The call box system consists of five major elements:

Technologically Advanced Call Boxes

The call box is an extremely rugged, weatherproof unit constructed from a thick grade of Lexan polycarbonate. The housing is designed for many years of durable service. Within the housing is the call box controller, which provides the logic that monitors the call box sensors, communicates with the maintenance system, and ensures that call delivery is properly accomplished. A high quality digital cellular transceiver is mounted in the call box enclosure. The cellular transceiver provides the communication link between the call box and the cellular telephone network. The call box handset is covered by a protective outer door, mounted so that it helps shield environmental sound while the call box is in use. Power for all call box functions is usually provided by a photovoltaic solar panel mounted at the top of the call box pole. Alternately, AC power can be used if available at the call box site location.

The Cellular Telephone Network

The call box is able to communicate with the Public Safety Answering Point (PSAP) through radio links to cell sites. Cellular telephone networks consist of a quantity of cell sites under the control of the Mobile Telephone Switching Office (MTSO). The MTSO establishes and controls the communication path between the cellular phone (via the cell site) and the normal land line telephone system. This allows mobile customers to traverse an entire cellular system (which may include being handed off from one cell site to another) without noticeable interruption in the communication path. Although call boxes are stationary devices, the cellular network will still command handoffs to balance the call traffic resources. The cellular system employs a digital format known as CDMA — Code Division Multiple Access. CDMA has been likened to a party: When everyone

talks at once, no one can be understood, however, if everyone speaks a different language, then they can be understood. CDMA systems have no channels, but instead encode each call as a coded sequence across the entire spectrum in what is called a "pass-band." Each pass-band is 1.23 MHz. In the digital domain, each voice conversation is modulated with a unique code (called a pseudo-noise code) that makes it distinguishable from the other calls in the frequency spectrum. Using a correlation calculation and the code the call was encoded with, the digital audio signal can be extracted from the other signals being broadcast by other phones on the network. This digital format has advantages over the older analog cellular systems. A much larger number of individual calls can be made using a given amount of RF (Radio Frequency) spectrum. Noise and interference can be suppressed as well.

The Public Switched Telephone Network

The Public Switched Telephone Network (PSTN) employs a complex of telephone lines, trunks, and switching gear that routes telephone calls from the originating telephone to the destination phone number. The telephone number specified by the call box will be passed to the PSTN by the MTSO, which will then route the call to the PSAP center.

The Call Box Maintenance Computer System

The call box maintenance center employs a computer database with complete, up-to-the-minute, near real-time alarm information on the entire call box system; thus it is able to keep the call box system virtually 100% operational. Computers running maintenance software designed for the call box are able to quickly recognize potential problems anywhere within the call box system. Abnormal situations detected by the maintenance computer are promptly displayed and printed for action by maintenance personnel.

The Call Box Dispatch or PSAP Center

The call box dispatch or PSAP center consists of an answering system that can detect ANI (Automatic Number Identifier) or ALI (Automatic Location Identifier). All call box control codes are single or double touch-tone commands. Call duration, call box volume control, and ringer control can be accomplished by means of the touch tone pad on the dispatch telephone instrument. For a complete system overview, see the Functional Block Diagram (Figure 1).

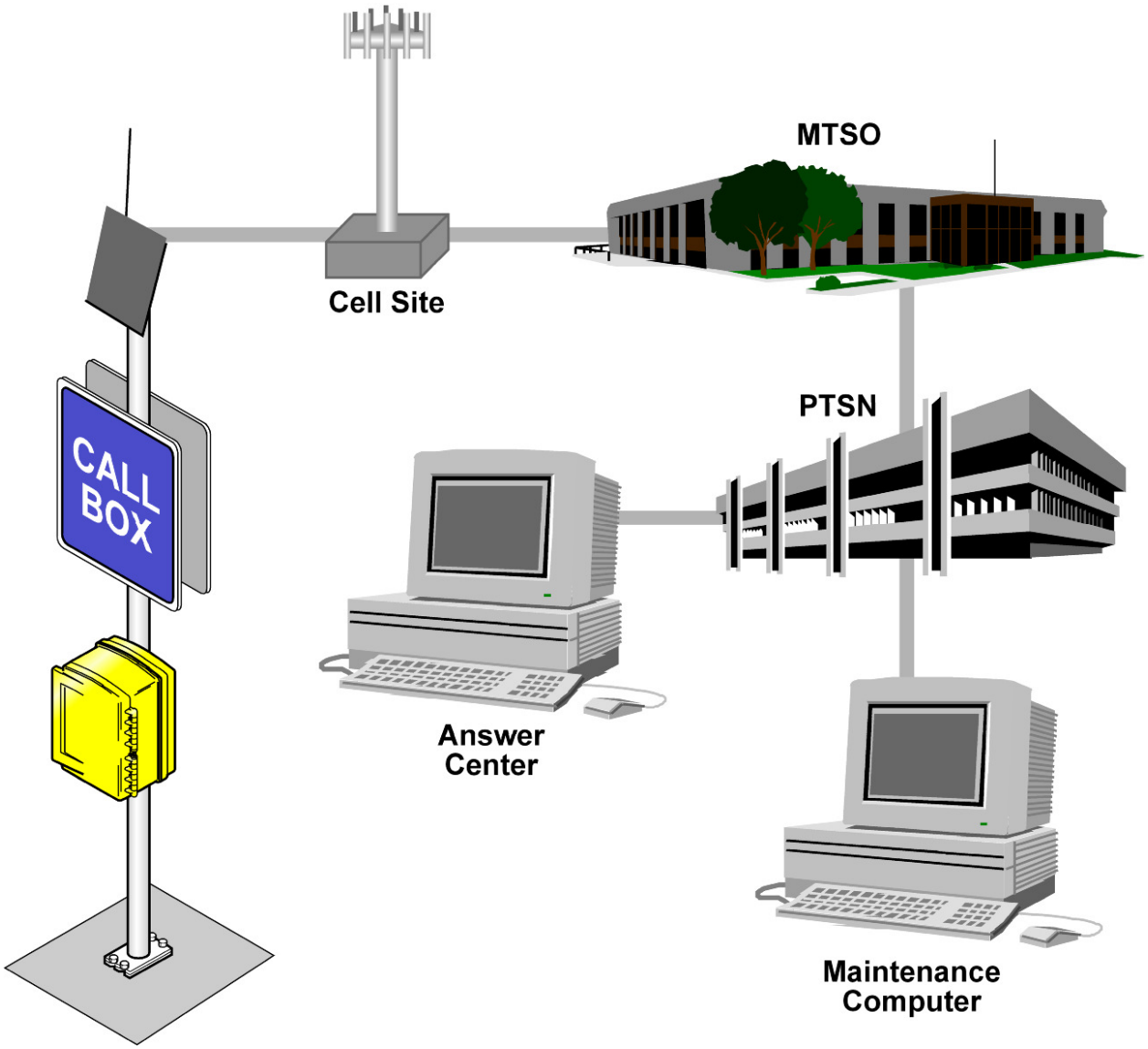


Figure 1. Functional Block Diagram

1-2 Transceiver Specifications

Kyocera Model M200 Series CDMA Transceiver

ITEM	SPECIFICATION
Manufacturer	Kyocera
Model	M200 Module
Service Type	CDMA and AMPS
Operating Bands: CDMA AMPS	 800 and 1900 MHz 800 MHz
Vocoders	13 Kbps (Voice) & EVRC
Temperature Range	-30°C to +60°C
Tx RF Output Power	0.6 Watts
Rx Sensitivity CDMA AMPS	 -104 dBm (0.005 FER) -116 dBm (12 dB SINAD)
Mode Preference	Digital
CDMA Pass-Band	1.23 MHz
RF Output Impedance	50 ohm (nominal)

1-3 Call Box Specifications

ITEM	SPECIFICATION
Height	21.6" at center
Width	13.12" extreme
Depth	8.0"
Weight	47.4 lbs.
Battery	17 Amp/Hours — 13 VDC

1-4 Call Box Drawings

The following pages show a typical call box installation (Figure 2), the front panel layout (Figure 3), and the call box interior (Figure 4).

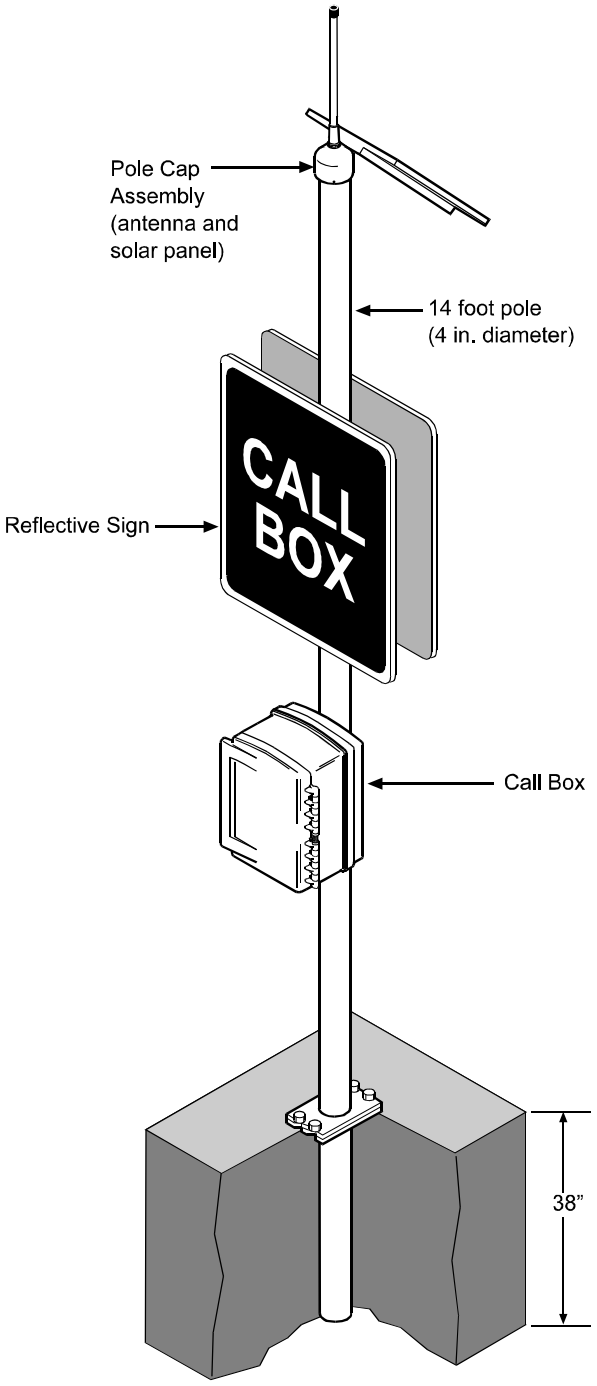


Figure 2. Call Box Installation Drawing

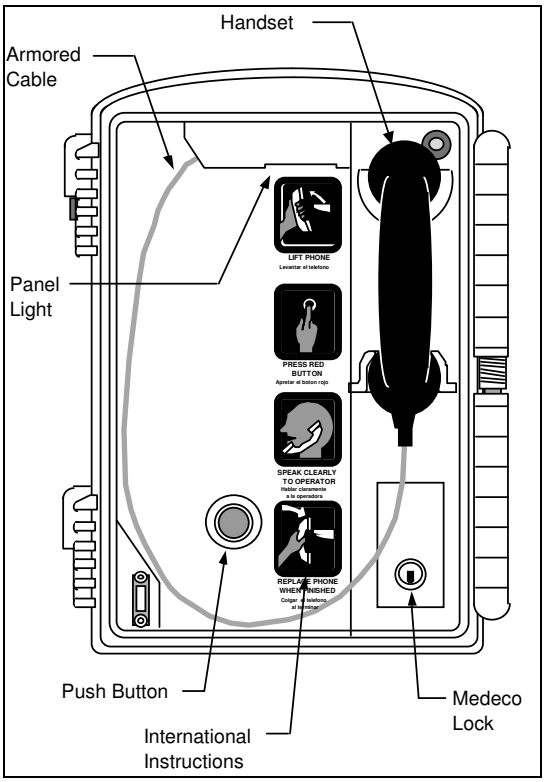


Figure 3. Call Box Front Panel

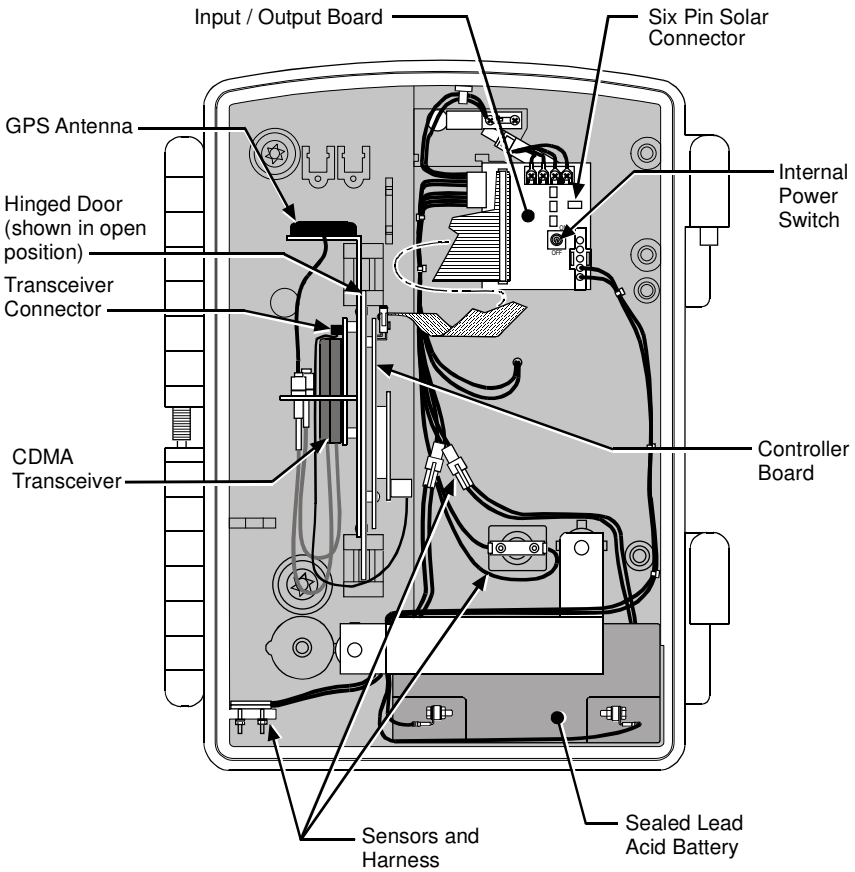


Figure 4. Inside View of Call Box Electronics

CHAPTER 2
Theory of Operation

2-1 Call Box

The call box will operate in one of three functional modes: the quiescent mode, the active mode, or the standby mode. The call box will be in the quiescent mode for the majority of each 24-hour day. In the quiescent mode, the call box controller powers down all but the essential electronics. This reduces the overall power requirement of the call box significantly. The call box will operate for approximately 11 days on a fully charged battery if operating in the quiescent mode with no solar charging provided. In the quiescent mode, the call box monitors internal and external sensors continuously. If the status of any of these sensors requires action, the call box controller will "wake up" the necessary electronic circuits and transition into the active mode.

All call box electronics, including the cellular transceiver, are powered up when in the active mode. In this mode, the cellular transceiver is able to transmit and receive voice and data, allowing the call box to make one of the following phone calls, depending on the condition causing it to enter the active mode:

1. Program Call
2. Motorist Call
3. Report Call
4. Alarm Call
5. Electronic Access Call

In addition to the active mode, the call box may also enter the standby mode. The standby mode is entered when an established telephone call is place on hold. In the standby mode the call box electronics and the cellular transceiver are powered up. The cellular transceiver, however, will not be transmitting. The standby mode is also entered when the front door of the call box is opened.

2-2 Program Calls

When a call box is installed, it is capable of making motorist calls immediately, but it still must be programmed with the information necessary to coordinate with the maintenance computer. Therefore, when all call boxes are first installed, they make a program call to the maintenance computer. This program call will be initiated by turning on the call box power switch or by using the electronic access feature. The call box will give the maintenance computer its Automatic Number Identifier (ANI), which allows the maintenance computer to recall information about this call box from a database. The maintenance computer will recognize the fact that this call box requires programming and begin an exchange of data. This data includes time of report call, days between report calls, what alarms are considered high priority, current RF signal strength, and any telephone numbers to be reprogrammed in the controller flash memory. When the exchange of information is complete, the call box will transition into the quiescent mode and will be ready to perform as designed.

2-3 Motorist Calls

Motorist calls are placed when a person opens the call box door and pushes the call button. When the call box controller senses that the front door is open, it transitions the call box into the stand-by mode. With the call box in the stand-by mode it is ready to place a telephone call, interpret electronic access inputs, or receive a telephone call. If the outer door of the call box is then closed or if the door is left open for more than two minutes without further action, the call box will automatically return to quiescent mode to avoid the waste of stored electrical energy.

When the user pushes the call button, the call box controller instructs the cellular transceiver to place a telephone call out of flash memory location 1, which contains the telephone number for the PSAP center. If the call box is in the middle of a report call when someone tries to use it for a motorist call, the maintenance call will be aborted and the motorist call completed. When a motorist initiates a call, the call box automatically connects to the PSAP center. When the dispatch operator answers the call, they may request the call box ANI or receive call box information by using caller ID provided by the cellular carrier. The dispatch operator may then converse with the call box user to determine their specific need.

2-4 Call Back (Standby)

Occasionally there is a need for the PSAP center to remain in communication with the call box for an extended period of time. In order to conserve cellular system airtime, it may be desirable to disconnect the phone call and reestablish it at a later time. To do this, the dispatch operator will send a control code (* pause 7) by pressing two touch tone buttons on the telephone instrument, causing the call box to enter the standby mode. This essentially puts the call box on hold. In this mode, the call box requires 60% to 85% less

battery power and conserves cellular airtime. In the standby mode the call box controller will keep the cellular transceiver powered up and waiting for an inbound phone call. The maintenance computer during a programming call programs the length of time the call box will remain in this standby mode. Once this time has passed, the call box will return to the quiescent state. At any time, while a motorist is on hold, pushing the call button will bring the call box back to the active mode and reestablish the phone call with the PSAP center.

Once the PSAP center is ready to reconnect with the call box, the operator recalls the cellular telephone number of the call box from the database and connects to the call box by normal means. If the motorist is at the call box with the front door open, the call box controller senses the cellular transceiver ringing and answers the phone call, which reestablishes contact between the PSAP center and the motorist. If the call box patron does not respond to the operator's voice, the operator can activate a ringer. If no one answers the ringer, the operator can terminate the call, putting the call box into the quiescent mode.

2-5 Report Call

Report calls are made by the call box at intervals that have been programmed by the maintenance computer. At the report call time, the call box controller transitions the call box into the active state, and places a telephone call to the maintenance computer. When the telephone link is established, the maintenance computer will poll the call box for status. The call box will respond with the status of the following items:

- Outer Door Open or Closed
- Lamp Pass or Fail
- Handset Good or Bad
- Battery Voltage Acceptable or Unacceptable
- Microprocessor Initialization Pass or Fail
- Solar Panel or AC/DC Module Disconnected
- No Solar or DC Power Detected for 16 Hours
- Inner Door Open or Closed
- Call Box Standing or Tilted
- Excessive Cellular Call Attempts
- Incomplete Maintenance Programming
- Radio Frequency Signal Strength
- Recent Account of Call Usage to the Answer Center

After the status of these items is received, the maintenance computer will terminate the telephone call and record the status information on the maintenance computer. If the call box does not make its scheduled report call, it will be identified on the next Exception Report run on the maintenance computer. Normally, call boxes are programmed to make report calls at times when conventional cellular usage and call box call usage is low. This is typically between 10:00 p.m. and 6:00 a.m.

2-6 Alarm Call

The call box controller monitors multiple sensor inputs and performs self-diagnostics. If the call box controller senses an unacceptable condition from a sensor, it either acts immediately on the input, or it will note the condition for reporting on the next scheduled report call. When the call box is programmed, it receives information on which sensors to mask. If a sensor is not masked, the call box controller will act immediately on the unacceptable condition indicated from the sensor. If the sensor is masked, the call box will wait until its next report call to indicate the unacceptable situation to the maintenance computer.

The following sensors are part of every call box:

- **Outer Door Open Sensor**. This sensor detects when the outer door of the call box has been opened, and causes the call box controller to place the call box in the standby mode. If the sensor indicates the door has remained open for a defined (programmable) period of time, it is recorded by the call box controller for either an immediate alarm call or the next scheduled report call, depending on masking configuration.
- **Lamp Failure Sensor**. This sensor detects when a lamp filament has failed.
- **Handset Failure Sensor**. If the handset ear piece or microphone assembly fails either by vandalism or function, this sensor will alert the call box controller.
- **Battery Voltage Sensor**. This sensor checks the voltage level of the battery. If the battery reaches a voltage level indicating low capacity (<11.0 VDC), the sensor will alert the call box controller. The critical battery voltage level is factory set for the specific battery installed in the call box.
- **Solar Panel Disconnected**. Should the solar panel or DC power cable be disconnected or cut, a system power alarm will be sent to the maintenance computer.
- **16 Hour Missing Power**. In the event that power is not detected for more than 16 hours, the missing power sensor will alert the call box controller.
- **Inner Door Open Sensor**. This sensor indicates that the electronics compartment of the call box has been opened. When used in conjunction with the electronic access feature, the call box controller will distinguish between an authorized and unauthorized entry into the call box and send the alarm call out with this status.

- **Tilt Sensor**. This sensor (mercury switch) detects whether the call box has been tilted beyond 45° from vertical position.

Typically, sensors are masked unless there is reason to act upon the failure immediately. The tilt sensor, for instance, should always be acted upon immediately since it probably involves an accident or theft. On the other hand, the outer door open sensor will commonly be masked, as there is no need to act immediately when the outer door of the call box is left open. When the call box controller receives an unmasked alarm, it immediately brings the call box to the active state and places an alarm call to the maintenance center where the call is displayed on the computer screen. If the alarm is masked, the call box will report the alarm condition at its next scheduled report call time.

2-7 Electronic Access

Electronic access is a powerful feature that allows authorized individuals to use the call box for calls other than to the answer center. The controller flash memory used in the call box has 30 memory slots for storing telephone numbers. Flash memory locations 1, 2, 3, 8, 9, and 30 are reserved for normal call box system use, while memory locations 4 through 7 and 10 through 29 are used for electronic access.

When authorized persons use a call box, they first approach the unit and open the outer door. This action causes the call box to transition into the standby mode. The authorized person will then hold an automatic tone dialer up to the microphone of the handset. The technician can then press a button on the tone dialer that will then issue a tone code to the microprocessor in the call box. The automatic tone dialer is an off-the-shelf unit that stores many telephone numbers and plays them back in standard DTMF tones when a memory recall action is taken.

If the proper access tones are given, the call box controller will place a telephone call out of one of the available 24 memory slots of the controller flash memory. The phone numbers in these 24 memory slots can be programmed during any call to the maintenance computer. The electronic access feature has a great number of important applications. One is to give maintenance personnel the capability to use that call box to telephone a repair center or other supervisory telephone numbers. Maintenance personnel can also use electronic access to induce report calls or to obtain authorized entry into the call box.

CHAPTER 3
Troubleshooting

3-1 Test Procedure

Digital call boxes are best tested using the Aurora Programming Kit (6000-0470). This kit contains a special call box connector cable, software, and instructions. The software is loaded into any Windows 98 based computer (or higher), and the programming and test cable is connected to a serial or USB port. To commence programming or call box testing, connect the cable to J2 of the Input/Output board. Please note that the cable connector has one blocked pin connection. Match this up with the missing pin at the J2 connector. The call box should be powered off during this connection. Once the cable is connected, boot the computer to the Windows desktop. The following test procedure should be followed:

Diagnostics tab

1. Turn the call box power switch to the ON position (up). Pause 2 seconds or until the controller board lower LED begins flashing (D13). Click the EMTEST icon on the Windows desktop to start the EMTEST program.
2. If the computer connects properly with the call box, the number 1 box under polled modules will be checked. If so, click the Call Box tab located on the upper left part of the screen.
3. The screen will now display the Call Box Programming and Diagnostics screen. This screen is used to monitor the current state of the call box as well as testing all features. Click the following two boxes:
    a. Manual Override of Outputs
    b. Stop Maintenance Calls
4. The current state or condition of the following call box functions can be monitored and or tested.
    a. **RSSI (Received Signal Strength Indicator)**. The RSSI is a measure of how well the call box is receiving the local cell site. This measurement should be made with the antenna connected. The reading is in negative dBm. The proper range for reliable call box communications is from –55 dBm to –105 dBm. The more negative the number, the weaker the signal is being received from the nearest cell site. For example a reading of –105 dBm is much weaker than a reading of –75 dBm.

b. **Handset Microphone** – PASS or FAIL.

c. **Handset Ear Piece** (speaker) – PASS or FAIL.

d. **Battery** (voltage) – PASS or FAIL. The actual battery voltage can be read in green lettering just below the picture of the battery in the upper left corner of the screen.

e. **Solar Sense** – PASS or FAIL. Note the picture of the solar panel in the upper left section of the screen. If the solar panel or DC power is connected, a happy face will be shown; if not, a frowning face will be shown.

f. **Tilt** – PASS or FAIL. If the call box is tilted greater than 45 degrees from vertical, Fail will be indicated. This test uses the mercury tilt switch located on the Input/Output board.

g. **Front Panel Light** – PASS or FAIL. If the lamp and wiring are good, PASS will be indicated.

h. **Front Panel Light** – OFF or ON. The front panel light can be tested by checking and un-checking the box at the beginning of this line. This test will override the solar connection light disable feature of the call box.

i. **Call Connected LED** – OFF or ON. The call connected LED light can be tested by checking the box at the start of this line.

j. **Horn** – OFF or ON. The horn or sounding device located up and under the solar panel can be tested by checking the box at the beginning of this line. If the sounding device is ON, the picture of this device will show a happy face that is opening and closing its mouth.

k. **Area Light** (if used) – OFF or ON. The area light, if present, can be tested with this line. The picture of the area light will show a lit light bulb if this feature is ON.

l. **Night Strobe** (if used) – OFF or ON. The strobe light, if present, can be turned on by checking the box at the start of this line. The night strobe is normally OFF if solar charging is not present. If the night strobe is ON, the picture of the strobe will show a lit light bulb.

m. **Side Tone** – OFF or ON. Side tone (feedback from the handset microphone to the handset speaker) is normally ON when the call box is powered up. Side tone can be turned OFF by checking the box at the beginning of this line.

n. **Audio Gain** – NORMAL or HIGH. The handset speaker audio gain can be turned to high mode by checking the box at the start of this line.

o. **Mic** (microphone) – NORMAL or MUTED. The handset microphone can be changed to the muted mode by using this line.

p. **Charge Power** – OFF or ON. The output of the solar panel cable or DC power cable can be noted for "charge power" on this line.

q. **Radio** – OFF or ON. The radio power state is determined by this line.

r. The picture of the call box located in the lower right side of the screen displays the current condition of the call box. If the back door is open, the picture will display a call box with the back door open. If the front door is open, the picture will display that as well. If the front panel light is ON, a lit light bulb will be displayed at the upper center part of the call box. The call button can be tested by pushing the call button. If a hand pointing to the button is displayed, the call button is working properly.

Phone Numbers tab

1. Click the Phone Numbers tab to display all call box calling numbers and the ANI (Automatic Number Identifier) of the call box.
2. Flash memory locations 1, 2, and 3 are reserved for the Answer Center phone numbers. For one button call boxes, the Answer Center phone number is programmed into memory 1 location.
3. Flash memory locations 4 through 7 and 10 through 29 are reserved for the owner of the call box system. Any number programmed into these memory locations can be called with the use of a tone dialer and a specific code is used to select which number will be called. This feature is not intended for the public. See the section on Electronic Access.
4. Flash memory location 8 is used for an Alarm computer. Some Answer Centers have a computer for the decoding of call box alarm calls such as tilt or handset failure. These Answer Centers can take action immediately upon receipt of these alarms.
5. Flash memory location 9 is used for the telephone number of the call box maintenance computer. When call box alarms occur, this number will be dialed automatically by the call box to report the alarm condition.
6. Flash memory location 30 is used for the ANI (Automatic Number Identifier) of the call box. The ANI is the number used by the call box maintenance computer to identify specific call boxes. This number is also used by the Answer Center to ID call boxes. Every call box in a system must have a unique 4-digit ANI programmed into flash memory location 30.
7. Clicking the "Read Phone Numbers From Call Box" button will read all current numbers programmed into the flash memory.
8. To make changes to any phone number or to change the ANI, click the box of the line to edit. The old number can be erased and a new number entered. The phone numbers can begin with a 1 and area code or just be a local 7-digit phone number. Dashes can be used as part of the phone number. Edit all numbers that should be changed and then click the "Save Phone Numbers to Call Box" button. To

permanently save these numbers in the flash memory, click "Program Call Box Flash." To indicate that all numbers were saved, the "Program Call Box Flash" button will turn green.

9. To load or save all phone numbers to a file, click the Load or Save file buttons. The file can then be named for future use and reference.

NAM Programming Tab

The NAM Programming tab is used for this call box model. The model number — Kyocera M200 — is displayed. Internal programming of the cellular phone number and cellular network code is accomplished using the NAM Programming Tab (See Section 3-2 below).

3-2 Transceiver NAM Programming (Kyocera M200)

Transceiver NAM programming (cellular phone number) must be done with the EMTEST computer connected to the call box. Connect the EMTEST cable to the interconnect board (J2) and turn the call box power switch on. Click the EMTEST icon. When the program loads, click the NAM Programming Tab.

1. The ESN (Electronic Serial Number) of the transceiver will be displayed in the upper left section of the screen. This number can be displayed as a hexadecimal number having eight digits containing letters and numbers. The ESN can also be displayed as a decimal number showing numbers only. A Hex and Dec button allow the ESN to be displayed in either format.
2. Programming the cellular telephone number into the transceiver module can be done within the block shown at the middle of the screen.
3. The top line shows the transceiver model number – **Kyocera M200**.
4. **Directory Number** – Enter the new mobile number obtained from the carrier and matched up with the ESN of the transceiver. This number will be 10 digits (area code and phone number) and should be entered without spaces or dashes.
5. **MIN** – Enter the same 10 digit number as entered in the Directory Number line (area code and phone number) without dashes or spaces.
6. **MCC** – This number is the Mobile Country Code and should always be 310 for the United States of America.
7. **MNC** – This number is the Mobile Network Code and usually will be 00 especially if using the Verizon Network.
8. When all lines have been filled in correctly, click the **Save to Phone button**. This button will turn red and stay red during the transceiver programming process. When this button turns green the transceiver has been successfully programmed. Do not turn off call box power during the programming process which can take up to 60 seconds to program. When the Save to Phone button

has turned green, the power to the call box must be turned off for the process to be completed. Call box power can then be turned back on and EMTEST restarted and the NAM programming of the mobile number can then be verified.

9. **The transceiver module can also be programmed over the air (Verizon Only).** This can be done when Verizon has the ESN numbers in their system and they have assigned mobile numbers to be matched with the ESNs. To program the transceiver module over the air, an antenna must be connected to the call box antenna port. Connect the EMTEST computer to the interconnect board at J2 and turn the call box power on. Click the **EMTEST icon** and then click the **Callbox Tab**. When the program loads, click the **Diagnostics Tab**. Enter the number *** 2 2 8 9 9** in the dial box and then click the **Send Tab**. This programming call can be monitored by listening to the call box handset. Music will be heard and when three beeps are heard, the transceiver module has been programmed. This process can take up to 60 seconds. Do not turn the call box off until this programming has completed as the transceiver can be damaged.

Exiting Call Box Programming and Diagnostics

When finished with the Call Box Programming and Diagnostics program, click the Return tab and then click the Exit button to terminate the program. Turn the call box power switch to the off position (down) and remove the cable connection to J2 of the Input/Output board. The next time call box power is turned on, the call box will call the maintenance computer for an operational programming call.

3-3 Check Tuning of Battery Charging Circuitry

The battery charge controller circuitry is factory set to optimally charge the battery that was originally installed in the call box. This circuitry is very stable and should not be adjusted unless problems with battery charging have been noted or the battery has been replaced. The following procedure should be followed to tune the charging circuitry.

1. Make sure the call box is fully connected and powered on. The Input/Output board power input connector (J10) must be connected to a variable DC power supply and must have at least 17 Volts DC input to the board on the solar panel input pins. Optionally the solar panel can be used as long as weather conditions are sunny and the time is near mid-day. In addition, the green LED on the controller board (6020-0300) at D6 must be illuminated. This is the battery float indicator. When the LED is on, the battery is in float mode and is not being charged by the power supply or solar panel. This D6 LED can be used to test the solar panel power output or the AC/DC supply output. If the call box power switch is off and the DC power is connected, the LED will be on (lit) if power is present. When the call box power is on, this LED then indicates the battery charging condition (ON = Float, OFF = Charging).

2. If D6 is on, measure the voltage between ground (TP3–GND) and TP2–BAT SET on the controller board. TP2 is located near the middle, left side of the controller board. The voltage should be the voltage per cell of the battery when in the fully charged condition. For most 12-volt batteries the voltage level should be set to 2.3 Volts per cell.
3. If adjustment is necessary, adjust the blue potentiometer until the proper value (2.3 VDC) is displayed on the voltmeter.

3-4 PSAP Answer Center Call

The call box should be tested for proper operation of a motorist call. Open the call box front door and activate the Call button. The call box will recall flash memory location 1 stored in the controller board and place the call. Verify this operation with the answer center operator and determine that audio in both directions (Tx and Rx audio) are clear and undistorted. If the call is not completed, refer to the following Troubleshooting procedures.

3-5 Troubleshooting Procedures

The Troubleshooting section is organized in conjunction with the call box test section. The failures covered are in order of their potential occurrence during the call box test. When a failure occurs during the call box test, a reference to the appropriate paragraph of the troubleshooting section is given. It is assumed that the tests are performed as outlined in Sections 3-1 through 3-4. If the tests are not performed as outlined, the effectiveness of this Troubleshooting section is reduced.

3-6 The Call Box Does Not Complete Its Power-On Sequence Properly

This type of failure has many potential causes. It could be anything from an improper cable connection to failure of the call box electronics. The procedure outlined below is organized to provide the quickest and most logical way to determine the source of the problem.

1. Check the main fuse (F7 - 5 Amp) first, and then check the power connections on the battery. If the connections are loose or not made, simply correct the situation and re-test the call box. If the battery connections are reversed and power has been turned on, a protection diode will shunt current to ground through the main fuse. Correct the reversed power connection and replace the main fuse.
2. Verify that the cable connection between the small radio interface board (6020-0678) mounted to the controller board and the cellular transceiver is secure and properly attached. If connections are not properly made, correct the problem and re-test the call box.
3. If the transceiver does not power up after turning on the call box power switch located on the I/O board, replace the controller and radio interface boards and re-

test. If this does not fix the problem, first replace the transceiver data cable, and then replace the transceiver itself.

4. If the transceiver does not make a programming call to the maintenance computer, check to see that call box calling numbers and ANI have been programmed into the controller board. This must be done using a computer and an Aurora Programming Kit (6000-0470).
5. If the call box does not power the transceiver down after making a programming call, replace the controller and/or radio interface boards.
6. If the call box, after successfully completing the power-on sequence, makes a call to the maintenance computer, the call box is operating correctly.

3-7 Transceiver Fails To Power Up and Recall Controller Memory Location 9 When an Alarm is Induced

This situation will occur when an alarm is not acknowledged or the alarm circuitry does not function properly. The procedure outlined below will assist in determining the source of the problem.

1. A magnet passed over the inner door proximity switch should induce an alarm call. Re-attempt this alarm by holding the magnet on the proximity switch for two seconds. If the call box does not respond, induce a system power alarm by pulling the solar power cable out of the J10 connector. If the call box then initiates a call to the maintenance computer, there is a problem with the inner door circuitry. If there is no response when the solar power alarm is induced, replace the controller and radio interface boards.
2. If the inner door circuitry is deemed bad, perform the following steps to determine the source of the problem:
    a. Make sure the magnet being used is strong enough to induce the alarm. Attempt to induce the alarm by holding the call box main housing closed against the rear housing for a few seconds. This uses the magnet from the back plate to initiate the inner door alarm. If the alarm call is made, the magnet used to induce the alarm is not strong enough.
    b. Check the connections on the proximity switch.
    c. If the proximity switch is properly located and securely connected and the problem still persists, the proximity switch itself can be tested. Disconnect the proximity switch from the harness and attach ohmmeter leads across the two pins of the switch wires. Move a magnet onto the proximity switch and observe the ohmmeter. When the magnet comes within ½" of the proximity switch, the effective resistance should go to near 0 ohms. If it does not, the proximity switch should be replaced. If the proximity switch appears to be in working order, replace the following items in the order listed, one at a time:
        (1) Controller and radio interface boards.
        (2) Sensor harness

3-8 Maintenance Computer Phone Number Is Not Retrieved After Alarm Condition Is Encountered

If the alarm circuitry is functioning and the transceiver has powered on, but the call box does not place a call to the maintenance computer, perform the following troubleshooting procedure:

1. Verify that the controller board flash memory location 9 is properly programmed with the maintenance computer phone number. If it is not, reprogram memory location 9 with the correct maintenance computer phone number and re-test the call box.
2. If flash memory location 9 is programmed properly and the phone call is not initiated, either the controller board or radio interface board has failed, or the cable between the radio interface board and the transceiver has failed. Replace the controller boards first, and if that does not fix the problem, replace the cable.

3-9 Maintenance Computer Does Not Answer Phone Call From the Call Box

If the maintenance computer does not respond to an alarm or report call, a problem could exist with the maintenance computer, the call box, or the cellular phone network. Perform the following troubleshooting procedure to determine the source of the problem.

1. Try to determine if the maintenance computer did not answer due to a phone system problem. If necessary, reinitiate the alarm and when the call box attempts to call the maintenance center, listen for cellular reorder tones, busy signals, or a phone that rings with no answer.
    a. If a cellular reorder tone is encountered, it could be due to poor cellular coverage in the area, an improperly programmed cellular transceiver, or an improperly activated cellular transceiver. Refer to the transceiver programming instructions (Chapter 3 Section 3-2) to verify that it has been properly programmed. If it has not, correct the programming errors and re-test the call box. If improper cellular transceiver activation is suspected, contact the cellular provider to verify the transceiver ESN and phone number. If the problem is caused by poor cellular coverage in the area, changing cellular providers, or replacing the omni-directional antenna with a high gain directional antenna, or relocating the call box are the only alternatives (unless the cellular network is simply having temporary difficulties). If cellular coverage is good and the problem persists, replace the cellular transceiver and re-test the call box.
    b. If a busy signal is encountered, it is either because the trunk is busy (no phone line is available to carry the phone call) or the maintenance computer phone line is off hook. In both cases the call box will retry the call five times. In general, the maintenance computer should not be busy. If it is, it should be checked. If the maintenance computer is locked in the off hook state, it should be repaired by a qualified PC technician. If the

busy signal is still encountered and the maintenance computer is functioning properly, follow the procedure of Section 3-5 above.

c. If the maintenance computer does not answer the call, verify that controller flash memory location 9 is properly programmed with the maintenance computer phone number. If it is correct, there is a problem with the maintenance computer. Contact the maintenance center to verify that the maintenance computer is on and running the appropriate software. If the maintenance computer is in order, attach a phone to the maintenance computer phone line and reinitiate the alarm. If the phone in the maintenance center rings, a hard failure exists within the maintenance computer. If the phone does not ring, the phone number programmed into memory location 9 may be wrong. If necessary, have a PC technician repair the maintenance computer, but before calling the technician, try to reset the computer by turning it off and then back on (cold re-boot).

3-10 Call Box Status Indication Not Normal

When a call box calls the maintenance computer, the transceiver powers up and is assigned a channel. This is the system setup procedure. The transceiver will then dial the maintenance computer. After two rings the maintenance computer will answer and ask the call box for status information and identification. The call box responds with the status of the call box and its ANI (Automatic Number Identification) and checksum digit.

The format used is the following: **ABCDEXXXXc**, where:

A is the leading digit and never changes. This digit is actually a DTMF star (*).

BCDE are four decimal numbers that contain the status information of the call box.

XXXX is the 4-digit ANI.

c is the checksum number.

This section of the maintenance manual identifies the various combinations of status digits and what the call box technician should do in each case.

1. Digit **B** status is concerned with program errors, cellular errors, and report calls. The following table refers to this digit. Program errors refer to incomplete or faulty programming of the call box by the maintenance computer. Cellular errors are recorded when the call box makes numerous (10) call attempts within a 24-hour period and the calls were not completed with a DTMF “0”. This can occur if the programming, report, or alarm call are not terminated with a DTMF “0” at the end of the call. These are dropped calls. The report calls are the regularly scheduled check-in calls made by the call box to the maintenance computer.

First Status Digit Table

B	DESCRIPTION OF STATUS	SEE SECTION
0	All Clear	None
1	Report Call is Being Made	
2	Cellular Error is Encountered	
3	Cellular Error Encountered with a Report Call	
4	Program Error Encountered	
5	Program Error Encountered with a Report Call	
6	Program Error and Cellular Error Encountered	
7	Program and Cellular Error Encountered with a Report Call	

2. Digit **C** status is concerned with program calls, front door alarms, and battery alarms. The following table refers to this digit:

Second Status Digit Table

C	DESCRIPTION OF STATUS	SEE SECTION
0	All Clear	None
1	Battery Alarm Encountered	3-20
2	Front Door Alarm Encountered	3-21
3	Battery Alarm with Front Door Alarm Encountered	
4	Program Call Being Made	
5	Program Call and Battery Alarm Encountered	
6	Program Call and Front Door Alarm Encountered	
7	Program Call, Front Door Alarm, and Battery Alarm	

3. Digit **D** status is concerned with handset alarms, tilt alarms, and solar panel alarms. The following table refers to this digit:

Third Status Digit Table

D	DESCRIPTION OF STATUS	SEE SECTION
0	All Clear	None
1	Solar Power Alarm is Encountered	3-17
2	Tilt Alarm is Encountered	3-18
3	Solar Alarm and Tilt Alarms Encountered	
4	Handset Alarm Encountered	3-19
5	Handset and Solar Alarms Encountered	
6	Handset and Tilt Alarms Encountered	
7	Handset, Tilt, and Solar are Encountered	

4. Digit **E** status is concerned with lamp alarms, built-in test alarms, and inner door alarms. The following table refers to this digit:

Fourth Status Digit Table

E	DESCRIPTION OF STATUS	SEE SECTION
0	All Clear	None
1	Inner Door Alarm is Encountered	3-15
2	Built-In Test Alarm is Encountered	
3	Built-In Test and Inner Door Alarms Encountered	
4	Lamp Alarm Encountered	3-16
5	Lamp and Inner Door Alarms Encountered	
6	Lamp and Built-In Test Alarms Encountered	
7	Lamp, Built-In Test, and Inner Door Alarms Encountered	

. The checksum digit is a modulo 10 checksum of the previous eight digits (the four-digit status bits and the four digits of the ANI of the call box). The checksum is used to verify that a good communications path between the call box and the maintenance computer has resulted in proper data exchange. The proper checksum number is obtained by adding the eight digits and subtracting the "sum" from the highest 10s digit (in this case, 20). For example, call box number **0156** would send ***040101563** at the beginning of a program call to the maintenance computer. The checksum number is 3 and is calculated as follows:

0 + 4 + 0 + 1 + 0 + 1 + 5 + 6 = 17

20 - 17 = 3 = checksum

The sum of the status bits plus the ANI digits is subtracted from the next highest 10s place to obtain the checksum number. If the checksum is not correct, the call will be re-attempted. If the inability to get the proper checksum remains it could be due to a failed call box controller board, a problem with the cellular transceiver, or poor cellular coverage at the location of the call box. This can also occur if controller flash memory location 30 does not store a 4-digit ANI.

3-11 Call Box Does Not Get Programmed by the Maintenance Computer

After the maintenance computer answers the call from the call box and requests status and ANI, if the status indicates a program call is needed, a series of DTMF tones will be exchanged between the maintenance computer and call box. If there is a problem with the DTMF data exchange, the maintenance computer will repeatedly ask the call box for information (until the call box returns the correct information to the maintenance computer).

The technician at the call box can detect this exchange by paying close attention to the tones heard in the call box handset. If the DTMF * repeatedly is heard, the call box is probably not listening properly to the maintenance computer. This can also be the case if the DTMF * is heard repeatedly without a response from the call box. When this happens, it is due to one of two failure mechanisms:

1. This failure can occur when the quality of the cellular phone call is very poor. This is identified by audible noise during the phone call and by an unusually long programming cycle. If this occurs, reprogramming the call box will usually clear it up. In the case that call quality is always poor, the antenna connection and the antenna itself should be tested. On rare occasions, the cellular transceiver could be the source of the noise that prevents the data exchange from occurring properly.
2. If there is little or no noise during the call and the DTMF * is repeatedly heard, the controller board and or the radio interface board of the call box should be replaced.

3-12 Transceiver Does Not Power Down After Program Call

If the transceiver does not power down after a program call, the controller and radio interface boards should be replaced.

3-13 User Call Not Successful

When the call button is activated, the call box controller board commands the cellular radio to place a call to the phone number stored in flash memory location 1. Several types of failures could cause a call to be unsuccessful, but if the test procedure in Section 3-2 is followed prior to attempting the call, all but a few failures should be eliminated. These are detailed below.

1. The most likely problem that would prevent a successful call is a problem with the cellular transceiver or the cellular network. If a cellular reorder tone or intercept message is received when the call is attempted, the problem could be either a fault with the cellular network (such as poor coverage, heavily loaded cellular network, or cell site hardware failure), or a problem with the cellular transceiver. If the reorder tone is heard, the call will be attempted up to five more times by the call box. If the call is not completed, verify that flash memory location 1 contains the proper phone number. If an invalid number is entered, it will result in a reorder tone. Reprogram the memory location if necessary. If the memory location is programmed properly, contact the cellular carrier to see if cellular system problems have been reported in the area.
2. If no audible activity takes place when the call button is activated, the call button switch should be tested and or replaced.

3-14 Alarm Troubleshooting

When a call box places an alarm call to the maintenance computer, it has sensed a failure or abnormal condition. In addition, this abnormal condition might be reported to the maintenance computer during a report call. Whether an abnormal condition is reported during an alarm or report call is dependent on how the call box was programmed by the maintenance computer. To correct the alarm condition received by the maintenance computer, the following procedures should be followed by the call box technician.

3-15 Inner Door Alarm

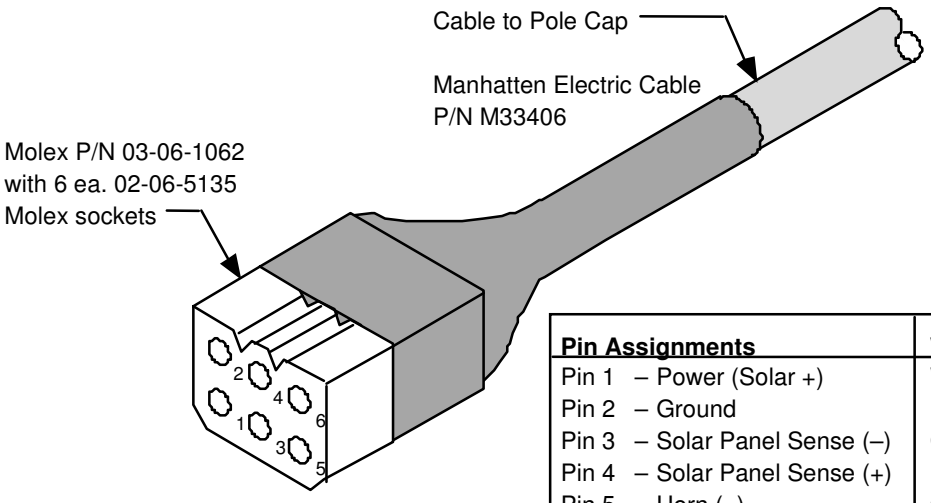
When the maintenance computer receives an inner door alarm, it indicates that the call box has been opened. If the alarm is of the authorized entry type, it means that a call box technician (or someone with the security code information) has opened the call box. An unauthorized inner door alarm should be acted on immediately. A vandal breaking into the call box, a false alarm, or a mechanical failure of the call box housing could cause the unauthorized inner door alarm. The technician should be prepared to replace the entire call box for this type of alarm. False alarms could be caused by a failed proximity switch, a missing door magnet, or controller board failure. See Section 3-7 for detailed troubleshooting methods for the inner door.

3-16 Lamp Alarm

The lamp alarm indicates that the call box front panel lamp has burned out. Typically, this just requires replacement of the lamp, which is done from inside the call box front housing assembly. Occasionally a false lamp alarm may occur. Before replacing the lamp, open the front door of the call box. If the lamp turns on, the lamp alarm received was a false alarm. The controller board should be replaced to correct this alarm condition only after verifying that the lamp wires are in good condition and the lamp is well seated in its socket.

3-17 No Solar Charging for 16 Hours Alarm

The solar charging alarm will be reported if there is no power from the solar panel for an extended period of time (16 hours). The technician should be prepared to replace the solar panel or solar cable and check the fuses for the call box when visiting a call box with a charging alarm. The figure shown below shows the connections and pin-out functions for the solar panel connector.

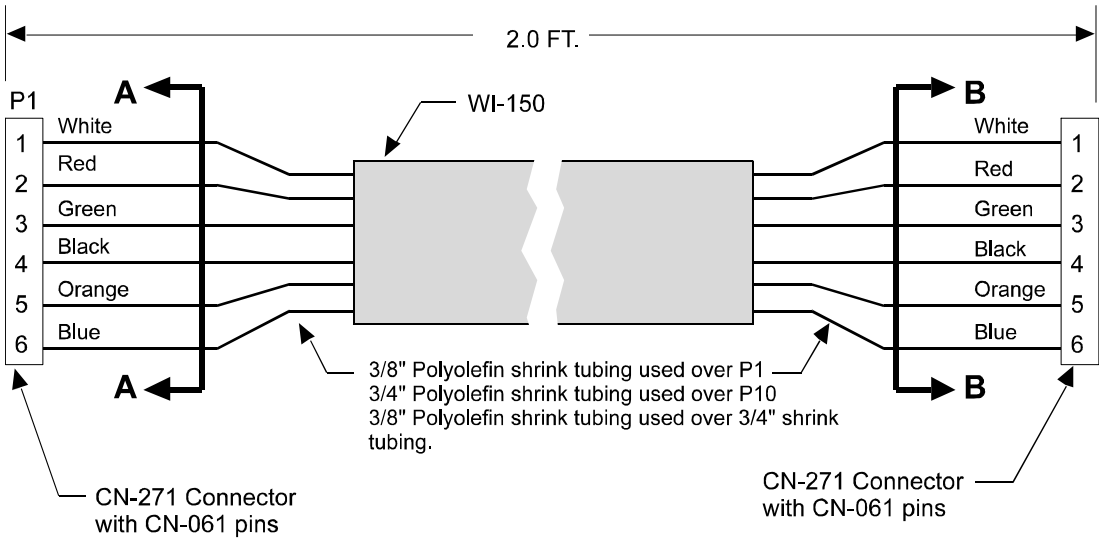


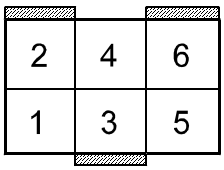
Pin Assignments	Wire Color
Pin 1 – Power (Solar +)	White
Pin 2 – Ground	Red
Pin 3 – Solar Panel Sense (–)	Green
Pin 4 – Solar Panel Sense (+)	Black
Pin 5 – Horn (–)	Orange
Pin 6 – Horn (+)	Blue

Figure 5. Pole Cap Wiring

This page shows a detailed view of the solar supply cable (6060-0118) used to connect the Solar Panel to the Input/Output board J10 (6020-0307). The following page shows the cable connection used to connect an AC/DC power supply to J10 of the Input/Output board (6020-0307).

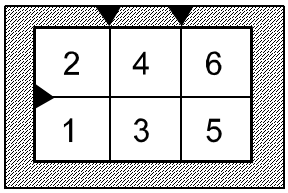
POWER HARNESS





Viewed from wiring side

View A – A



Viewed from wiring side

View B – B

Pin 1 - Power (+)
Pin 2 - Power (–)
Pin 3 - Continuity Loop
Pin 4 - Continuity Loop
Pin 5 - Horn (–)
Pin 6 - Horn (+)

Figure 6. DC Power Cable Wiring

3-18 Tilt Alarm

The tilt alarm will be reported if the call box tilts more than 45° from vertical for a period of 15 seconds or more. In this case, the technician should be prepared to replace the entire call box system. Knockdown, false alarms, foundation failure, or vandalism can cause tilts. If the technician sees that the call box has been knocked over, it will be necessary to determine the extent of the work needed to repair the call box. If there is any mechanical breakage, the call box should be replaced. The proper personnel with the correct equipment should repair foundation damage. If it is a false alarm, the technician should open up the call box and observe the tilt switch located at the lower right corner of the Input/Output (IO) board. If it appears to be straight, replace the IO board and re-test the call box.

3-19 Handset Alarm

The handset alarm occurs when the microphone or the speaker of the handset fails. The technician should visit the call box and make a push button a call and verify that the handset has failed before replacing it. If the alarm is a false one, the controller board should be replaced.

3-20 Battery Alarm

The battery alarm is sent to the maintenance computer when the voltage level of the battery falls below a specified value (<11.0 VDC). A bad battery, or failure to charge a good battery, can cause this failure. The battery alarm should be acted on quickly. If a good battery is allowed to be totally discharged, it can result in failure of the battery. The first thing to check on the call box is the battery voltage with the battery disconnected from the call box. If it is at an acceptable level, the alarm is false. In case of a false alarm, replace the controller board. If the alarm is valid, the problem could be with the controller board or failure of the solar panel to charge the battery. Check the output voltage of the solar cable assuming sunlight is present. If the voltage at the solar supply cable is acceptable, the battery is probably bad and should be replaced. If the alarm returns after several days, return to the call box and check the connections of the solar panel cable both upper and lower connector. The float charging circuitry for the battery is located on the controller board. With the call box turned on and when the upper green LED is lit, the battery is fully charged and in float condition.

3-21 Front Door Alarm

The front door alarm will occur when the front door is left open for long periods of time. This can be caused by a broken spring mechanism on the door, by a broken door, or because the handset was not replaced in its cradle. In the case of a false alarm, the failure could be due to a bad proximity switch or a defect within the controller board.

3-22 Maintenance Computer Reports

The maintenance computer contains the programming software necessary to program the operational personality and system parameters for each of the call boxes and interacts with the call box hardware through a cellular and PSTN communication link. The following is a brief description of the reports generated by the maintenance computer software. Consult the maintenance computer software user's manual for detailed descriptions.

3-23 Preventive Maintenance Reports

The computer database contains information pertaining to each of the call boxes that report to it. This information includes such items as call box location and date of initial installation. When the call box is opened properly by maintenance personnel, it will place a call to the maintenance computer and report an authorized entry. The maintenance computer assumes that preventive maintenance is taking place and logs this information with time and date. Management may then generate the preventive maintenance report that identifies all of the call boxes meeting these criteria.

3-24 Corrective Maintenance Reports

The maintenance computer is notified by the call box of any failures as they occur. The failures result in an alarm call from the call box to the maintenance computer. Alarms that have been masked (during initial call box programming) will not make phone calls to the maintenance computer as they occur, but they will identify themselves when the scheduled report call is made. Alarm calls will notify the maintenance computer of failures with the battery, solar power, handset, lamp, opening of the inner door, or any tilt in excess of 45°. The maintenance computer software prints a report of the alarm call as soon as the call is received (see Alarm Reports section). Detailed reports of all alarm calls may also be generated. Maintenance personnel typically should act on alarm calls as soon as they are received.

3-25 Exception Reports

On a regular basis, the maintenance computer software generates an exception report. This report lists any call box that failed to call in during the previous reporting cycle. This report includes the date and subsequent time span that the report covers, the date and time of the report, and the last status of any call boxes that did not report. The software has a standard set of failure types and categorizes the call box into one or more of these types. The report also contains the location of the call box that did not report in, the last time it checked in, and when it was scheduled to check in. The exception report is generated automatically and requires no human intervention for it to function on a regular basis. If necessary, reports can be generated at will. In addition to the report generation,

the software offers the ability to archive raw data to floppy diskettes, rectify any date or time change (daylight savings time changes and leap year date changes), and transfer report data via modem to other sites.

3-26 Alarm Reports

The call box continually is performing a built-in self-test in order to monitor its relative health. The results of the built-in test are sent from the call box to the maintenance computer. This data is sent during a normally scheduled report call or in the event of detection of an abnormal condition. Normally, data is sent immediately upon any of the following events:

- Low battery
- Failure of the solar panel
- Tilt in excess of 45º
- Failure of the handset microphone
- Failure of the handset speaker
- Inner door opened

When an immediate alarm is sent, the maintenance computer captures the data. A printout is then instantly generated showing all pertinent data.

The following information is normally sent out during the scheduled report call.

- Open front door
- Controller board error
- Excessive cellular errors
- Call counts and air time usage

CHAPTER 4
Primary Repair (Modular Level)

4-1 Corrective Maintenance

Corrective maintenance is performed on the call boxes on an as-required basis. Corrective maintenance is generally the result of a failed subassembly, or destruction or damage to the call box. The primary concern of corrective maintenance is to return defective call boxes to operational status as quickly as possible. Corrective maintenance is initiated as a result of a report call, an alarm call, or a failure to report in as scheduled (which generates an exception report at the maintenance center indicating a problem at the call box). Maintenance center personnel will attempt to determine the extent of damage to a call box from the reports generated by the maintenance computer. See Section 3-21 for a description of the maintenance reports.

4-2 Transceiver Considerations

The cellular transceiver mounted within the call box main housing should be properly activated and tested prior to installation of the call box. In addition to activation, the controller board flash memory must have a minimum of three memory locations properly programmed with the appropriate numbers.

1. Flash memory location 30 contains the 4-digit ANI (Automatic Number Identifier).
2. Flash memory location 9 contains the phone number of the maintenance computer.
3. Flash memory location 1 contains the phone number of the PSAP answer center location.
4. Optionally program flash memory location 8 for alarm computer number (if used).

These three primary memory locations should be programmed prior to installation of the call box. This is accomplished by using the Aurora Programming Kit (6000-0470) in conjunction with a laptop or other computer running Windows 98 or newer operating system. The primary memory locations should be checked during any field maintenance visit where the call box indicates a failure to call the maintenance computer or the PSAP center.

4-3 Cellular Transceiver Programming

When the call box is installed and/or during a field maintenance visit, it is important that the programming call to the maintenance computer be listened to carefully. This allows the installer to monitor the status of the call box during the programming procedure. The call box can then be tested while under control of the controller board. The actions taken by the cellular transceiver can be audibly monitored using the call box handset.

4-4 Modular or Assembly Replacement

The first step to modular or sub-assembly repair or replacement is gaining access to the electronics compartment of the call box. Remove the lock cover and unlock the face plate lock. This requires a special Medico key. Two tamperproof screws must be unscrewed on the right side of the main housing. At this point the main housing can be opened on the hinges. The following sections will describe the testing and or replacement of the major sub-assemblies:

1. **Transceiver**. The transceiver is mounted to a special circuit board attached to the controller board plate. If transceiver problems are suspected, the transceiver can be removed from the call box and replaced with the same model transceiver. Place a push-button call to the PSAP center. If the call goes through the system, test the audio in both directions to make sure there is no distortion. If the call does not go through, check for activation problems with the system carrier. Substitute another active transceiver and re-test the call box. If it is determined that the transceiver has failed, replace the transceiver. This may necessitate doing an ESN change with the carrier and then programming the original cellular telephone number into the new transceiver (See section 3-2). This must be done to protect the PSAP's ANI or ALI database.

2. **Controller Board**. The controller board controls the transceiver using a digital command set (logic and timing). The radio interface board passes commands to the transceiver from the controller board. The radio interface board provides power to the transceiver while in the call box. The types of problems that may be seen if any of the controller board and or the radio interface board components fail are as follows:

    - Call box fails to power up when front door is opened.
    - Call box fails to make complete maintenance calls after power up.
    - Call box sends false alarms to the maintenance computer.
    - Call box fails to send report calls at scheduled check-in date and time.

    If transceiver testing has not solved the problem, replace the controller and radio interface boards. This is accomplished by removing the controller mounting plate screws and swinging open the mounting plate. Remove the four controller board mounting screws. Disconnect the following controller board cables:

- Ribbon Connector from Input/Output Board at J1.
- Radio Data Connector at J2 of the radio interface board.

Replace the controller and radio interface boards and reconnect all connectors. Reinstall the transceiver and re-test the call box for proper operation. Check with the maintenance center computer for proper programming of this call box.

3. **Call Box Handset**. If the call box handset is suspected as being defective, the procedure for replacement is as follows:

   a. Open the call box housing assembly to the electronics section.

   b. Turn the call box power switch to the off position.

   c. Disconnect the four handset leads from the terminal block near top of the Input/Output board.

   d. Remove the three board mounting screws.

   e. Move the IO board down and out of the way.

   f. Remove two screws of the handset strain relief bracket.

   g. Remove the old handset and install new handset.

   h. Install strain relief hardware.

   i. Reapply RTV or silicon sealer to the handset entrance hole.

   j. Connect either White lead to terminal block screw #1 (Read left to right).

   k. Connect the other White lead to terminal block screw #2.

   l. Connect the Red lead to terminal block screw #3.

   m. Connect the Black lead to terminal block screw #4.

   The call box should then be reprogrammed with the maintenance computer. There should not be any handset alarm. The call box can then be tested with the PSAP center and the audio checked in both directions for clarity and lack of distortion and proper volume level.

4. **Call Box Low Battery Alarms**. If the maintenance computer reports low battery alarms day after day, verify that AC main power is applied (if used) and/or the solar panel tests properly for correct charging voltage and current, the controller board is suspected. The float charging circuitry may have failed. Replace the controller board as outlined above. After the controller board has been replaced, the maintenance computer should no longer receive low battery alarms from that call box.

5. **Battery Replacement**. Battery replacement requires removal of the battery bracket (two screws). The battery leads are then disconnected and the battery exchanged. Reassemble the mounting hardware. Call box batteries contain lead and must be disposed of properly.

6. **Front Panel Light Replacement**. Open the call box main housing and simply replace the light bulb located in a twist lock socket.

7. **Strobe Light Replacement (If Used)**. Failure of the strobe light is cause for replacement of the entire blue strobe fixture. Before replacing the light fixture, test the strobe connector on the IO board for 12 VDC under the proper circumstances.

   a. Flashing blue LED lights on at night when solar power is not present.

   b. To test the regulator output connector during the day, disconnect the solar cable, wait until the solar alarm has called into the maintenance computer and then test for 12 VDC at the strobe connector.

   The drawing below shows the wiring harness interconnections and serves as the functional block diagram for the call box.

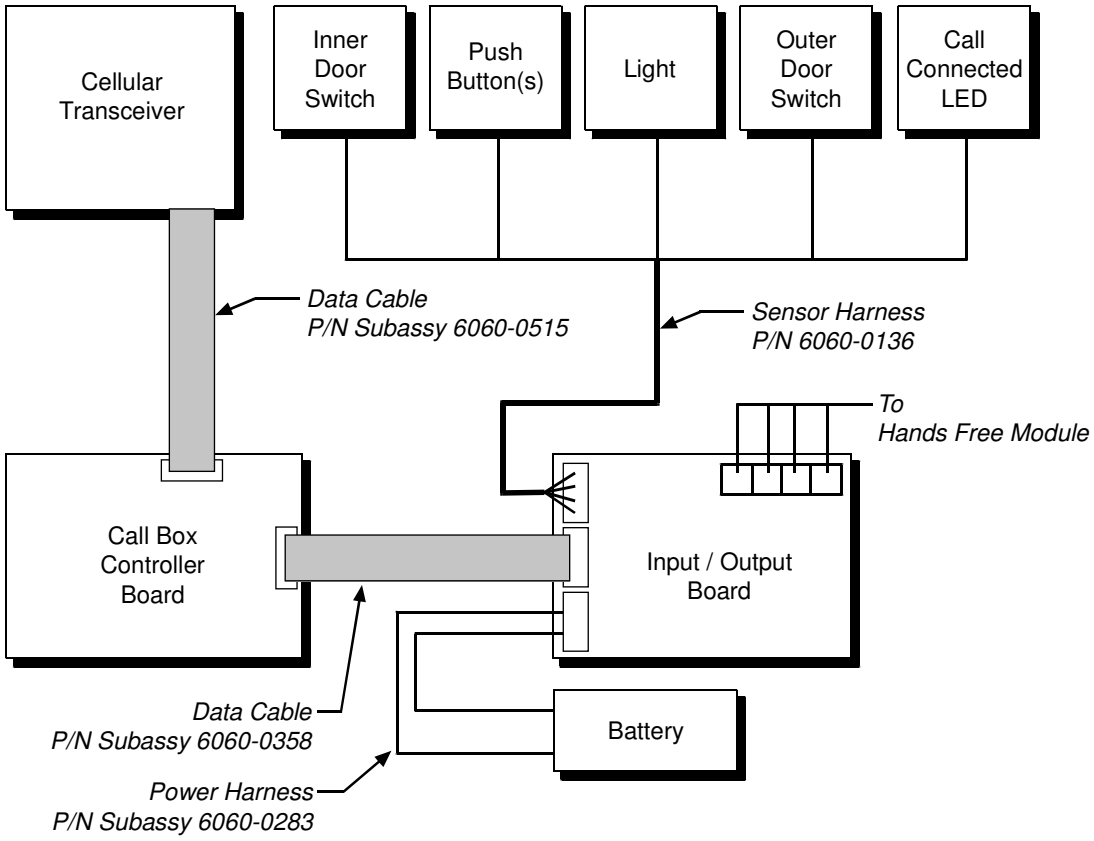


Figure 7. Call Box Interconnection Diagram

CHAPTER 5
Preventive Maintenance

5-1 Preventive Maintenance

Preventive maintenance is recommended twice a year for each call box in the system (environmental conditions, as well as call box placement, can greatly influence this figure). Preventive maintenance consists of visual, instrument, and operational checks of the wiring and components to detect any possible deterioration of the call box operation.

The following items are checked and or performed as a normal part of the preventive maintenance routine:

- **Call Box Assembly**
  - Clean housing exterior and interior
  - Clean call box handset
  - Check front door for proper operation
  - Check operation of interior panel light
  - Check operation of blue strobe light (if used)
  - Inspect and replace, as necessary:
  - Weatherproof seals
  - Electrical connections
  - Antenna connections

- **Call Box Operation**
  - Place call to PSAP center
  - Verify ANI or ALI decoding
  - Verify high quality bi-directional audio
  - Reprogram call box with maintenance computer

- **Support Assembly / Pole**
  - Pole assembly
  - Anchor bolts (if above ground)
  - Breakaway assembly (if above ground)
  - Call box signs and brackets
  - Antenna (mounting and connections)
  - Antenna cable (includes connection)
  - Horn (mounting and connection)
  - Blue strobe (where applicable)

5-2 Call Box Authorized Electronic Access

Before preventive or corrective maintenance can be performed on the call box, the service technician must first inform the maintenance computer at the maintenance control center that the entry to the call box is authorized and not the result of vandalism. Unless the call box has been extensively damaged, the following procedures must be performed.

To gain authorized access to the call box, the service technician uses a DTMF dialer to send a 5-digit security number suffixed with one of the following access control codes. The following code is used for electronic control features – **82269X**. The final digit of the code is listed below and determines the type of control. If the call box accepts the code, the call box light will blink the same number of times as the suffix digit.

PREFIX 82269_	
Code 0	A service technician first opens the front door, holds the dialer up to the handset microphone. The technician then sends the 5-digit security number with this code suffix to indicate this is an authorized entry, thus placing the call box in the authorized entry mode. The call box lamp will blink 10 times to acknowledge the proper code. This mode has a twenty-minute time-out. If nothing is done within this time period, the call box reverts to the quiescent mode.
Code 1	The service technician sends the 5-digit security number with this code suffix to place a program call. The maintenance computer can then program the call box with the preset data. The front panel light will flash one time and then make a complete programming call.
Code 2–7	When any of these codes are entered, the call box will place calls using the phone numbers stored in flash memory locations 2 through 7.
Code 8	The service technician sends the 5-digit security number with this code suffix to place a call to the alarm computer.
Code 9	The service technician sends the 5-digit security number with this code suffix to place a status call to the maintenance computer. The maintenance computer can also double as the alarm computer.
PREFIX 82267_	
Code 0–9	Entering any of these codes will cause the call box to make calls from the numbers stored in flash memory locations 10 through 19. For example by entering the number 822675, the call box will dial the telephone number stored in flash memory location 15.
PREFIX 82268_	
Code 0–9	Entering any of these codes will cause the call box to make calls from the numbers stored in flash memory locations 20 through 29. For example by entering the number 822683, the call box will dial the telephone number stored in flash memory location 23.

These codes are used to cause the call box to make calls out of memory slots 2–29. This gives the technician the ability to test the call box without accessing or disturbing the PSAP center. Using these security codes, the service technician can call cellular system test numbers, the phone company, or a local maintenance facility number. These secondary telephone numbers must already be programmed into the memory slots of the controller board. The maintenance computer can remotely program these numbers.

After the call box has been put into the authorized entry mode with the 5-digit security number and Code 0, the service technician can locally program the call box through the Aurora Programming Kit and a laptop computer.

CHAPTER 6

Call Box Primary Parts List

PART DESCRIPTION	PART NUMBER
Antenna/Sign Assembly	
Antenna 3 dB Cellular Dual Band.	4210-0067
Antenna GPS Assembly	4210-0068
Antenna 3 dB Cellular Dual Band - Stubby	4210-0055
Antenna Cable	6060-0436
Sign Mounting Kit	6040-4037
Call Box Sign Fiberglass(Eng. Grade-Generic)	3090-0033
Sign Wind Brace Kit	3090-0086
Blue Strobe Assembly (optional)	
Strobe Assembly - Blue	6000-0087
Strobe Assembly – Amber	6000-0087-02
AC/DC Power Supply (optional)	
AC/DC Converter Module	6040-0011
AC/DC Converter Cable	6060-0335
Call Box	
Complete Call Box Assembly	6000-0100-65
Call Box Main Housing Assembly	6040-4011
Call Box Back Plate Assembly	6040-4026
Call Box Front Door Assembly	6040-4010
Cellular Phone Kyocera M200 (Verizon)	5204-0051
Controller/Processor Board – (Aurora)	6020-0300
Radio Interface Board	6020-0678
Input/Output Board (I/O)	6020-0449
Cellular Phone Junction Board w/M200	6020-0679
GPS Antenna Bias Board	6020-0683
29" Handset w/ Armored Cord	6040-4014
Front Door Magnet	3070-0001
Inner Door Magnet	3070-0003
Pushbutton Assembly	6040-4018

Lock Cover Assembly	6040-4016
Lamp Bulb	6232-0002
Solar Panel Assembly	6040-4057
Solar Cable	6060-0130
Battery 12VDC 17AH	4240-0001
Battery Bracket	5004-0048
Call Box Ringer	4230-0008
Call Box	
Power Cable	6060-0283
Main Ribbon Cable (Controller to I/O Board)	6060-0358
Phone Data Interface Cable	6060-0515
How to Call Label Eng/Spn	4410-0017
Special Tools	
Call Box Programming Kit (Aurora)	6000-0470
Call Box Install Kit	6040-4035-09
Tamper Pruf Tool w/ bits	6040-4038
Medeco Key	3076-0005
20 dB Inline RF Attenuator	2035-0049
30 dB Inline RF Attenuator	2035-0050

CHAPTER 7
Wire List/Cable List Database

7-1 Input/Output Board (6020-0449) Connectors/Cables

J10 – Function – Solar Cable to Solar Panel Assembly or to DC Supply Module
Pin 1 Solar Power or DC Power (+) White Wire
Pin 2 Solar Power or DC Power (-) Red Wire
Pin 3 Continuity Loop Green Wire
Pin 4 Continuity Loop Black Wire
Pin 5 Not Used or Optionally Ringer (-) Orange Wire
Pin 6 Not Used or Optionally Ringer (+) Blue Wire

J6 – Function – Handset Connector Block
Terminal 1 (Viewed from left to right) – Either White Wire – Handset Speaker (+)
Terminal 2 Other White Wire – Handset Speaker (Analog Ground)
Terminal 3 Red Wire – Handset Microphone (+)
Terminal 4 Black Wire – Handset Microphone (-) (Analog Ground)

J7 – Function – Area Lighting Connector
Pin 1 12VDC (+)
Pin 2 Ground (-)

J8 – Function – Strobe Connector
Pin 1 12VDC (+)
Pin 2 Ground (-)

J9 – Function – Hands-Free Output Connector
Pin 1 12VDC (+)
Pin 2 Ground (-)

J11 – Function – Power Connector
Pin 1 Ground
Pin 2 Battery (+)

J5 – Function – Cable to Controller Board

Pin 1 Ground (-)
Pin 2 Ground (-)
Pin 3 and Pin 4 N/C
Pin 5 Solar or DC Power (+)
Pin 6 Solar or DC Power (+)
Pin 7 Regulator Output
Pin 8 Regulator Output
Pin 9 Area Light (+)
Pin 10 Area Light (+)
Pin 11 Strobe (+)
Pin 12 Strobe (+)
Pin 13 Ringer (+)
Pin 14 Ringer (+)
Pin 15 Spare Output (+)
Pin 16 Spare Output (+)
Pin 17 Discrete Output Power 12VDC (+)
Pin 18 Discrete Output Power 12VDC (+)
Pin 19 TTY Power 12VDC (+)
Pin 20 TTY Power 12VDC (+)
Pin 21 Main Power 12VDC (+)
Pin 22 Main Power 12VDC (+)
Pin 23 and Pin 24 N/C
Pin 25 CPU Power 3.3VDC (+)
Pin 26 CPU Power 3.3VDC (+)
Pin 27 RXD4
Pin 28 RXD5
Pin 29 TXD3
Pin 30 RXD3
Pin 31 TXD2
Pin 32 RXD2
Pin 33 TXD1
Pin 34 RXD1
Pin 35 and Pin 36 N/C
Pin 37 Lamp (+)
Pin 38 Missing Solar Panel
Pin 39 Main Call Button
Pin 40 2nd Call Button (if used)
Pin 41 3rd Call Button (if used)
Pin 42 Inner Door
Pin 43 Outer Door
Pin 44 Call Connect Light
Pin 45 Tilt Switch
Pin 46 Power Down
Pin 47 through Pin 50 N/C

Pin 51 Audio Ground
Pin 52 Audio Ground
Pin 53 Handset Microphone (+)
Pin 54 Handset Microphone (+)
Pin 55 Spare Analog 1
Pin 56 Spare Analog 2
Pin 57 and Pin 58 N/C
Pin 59 Ground
Pin 60 Ground

J1 – Function – Connection to Sensors and Call Button

Pin 1 Ground
Pin 2 Lamp (+)
Pin 3 Ground
Pin 4 Call Button
Pin 5 Ground
Pin 6 Inner Door Switch
Pin 7 Ground
Pin 8 Front Door Switch
Pin 9 Ground
Pin 10 Call Connect LED (+)

J2 – Programming Port (Normally Not Connected)

Pin 1 TXD1
Pin 2 TXD2
Pin 3 TXD3
Pin 4 Power Down
Pin 5 and Pin 6 N/C
Pin 7 CPU Power (3.3 VDC)
Pin 8 Ground
Pin 9 N/C
Pin 10 RXD5
Pin 11 RXD4
Pin 12 RXD3
Pin 13 RXD2
Pin 14 RXD1

J3 – Function – Second Call Button (if used)

Pin 1 Second Call Button
Pin 2 Second Call Button (Ground)

J4 – Function – Third Call Button (if used)

Pin 1 Third Call Button
Pin 2 Third Call Button (Ground)

J12 – Function – TTY Buttons (if used)

Pin 1 Call Button
Pin 2 Ground
Pin 3 Call Button 2 (if used)
Pin 4 Ground
Pin 5 Call Button 3 (if used)
Pin 6 Ground
Pins 7,8,9,10,11,12,13,14 – No Connection

7-2 Controller Board (6020-0300) Connectors/Cables

J4 – Function – Board to Board Connection to Radio Interface Board (6020-0678)

Pin 1 Serial Data
Pin 2 Serial Clock
Pin 3 TPU 0
Pin 4 TPU 1
Pin 5 TPU 2
Pin 6 TPU 3
Pin 7 Digital Output 8
Pin 8 Digital Output 4
Pin 9 Digital Input 7
Pin 10 Digital Input 6
Pin 11 Radio On
Pin 12 Not Used
Pin 13 /Reset
Pin 14 Digital Input 15
Pin 15 Digital Output 1
Pin 16 Digital Input 10
Pin 17 Digital Output 2
Pin 18 Peripheral On
Pin 19 Main Power (12 VDC)
Pin 20 Main Power (12 VDC)
Pin 21 CPU Power (3.3 VDC)
Pin 22 Ground
Pin 23 Ground
Pin 24 Through Pin 28 N/C
Pin 29 Analog Ground
Pin 30 N/C
Pin 31 Tone Gain +
Pin 32 Tone Gain -
Pin 33 and Pin 34 N/C
Pin 35 DSP Gain +
Pin 36 DSP Gain -
Pin 37 TX Audio +

Pin 38 TX Audio –
Pin 39 RX Audio +
Pin 40 RX Audio -

J1 – Function – Cable Connection to Input/Output Board J11 (See 6020-0449 J11)

J3 – Function – MCU BDM Port

Pin 1 /Data Strobe
Pin 2 /Bus Error
Pin 3 Ground
Pin 4 Data Strobe Clock
Pin 5 Ground
Pin 6 Freeze
Pin 7 /Reset
Pin 8 Data Strobe Input
Pin 9 CPU Power (3.3 VDC)
Pin 10 Data Strobe Output

J4 – Function – DSP JTAG Port

Pin 1 Test Mode Select
Pin 2 /Test Reset
Pin 3 Test Data In
Pin 4 Ground
Pin 5 CPU Power (3.3 VDC)
Pin 6 Ground
Pin 7 Test Data Output
Pin 8 Ground
Pin 9 Test Clock
Pin 10 Ground
Pin 11 Test Clock
Pin 12 Ground
Pin 13 Emulator Output
Pin 14 Emulator Output

J5 – Function – Flash Protect and Debug

Pin 1 DSP Debug Q1
Pin 2 DSP Debug Q2
Pin 3 DSP Debug Q3
Pin 4 DSP Debug Q4
Pin 5 and Pin 6 N/C
Pin 7 Ground
Pin 8 Flash Write/Protect
Pin 9 and Pin 10 N/C
Pin 11 DSP Debug Q5
Pin 12 DSP Debug Q6

Pin 13 DSP Debug Q7
Pin 14 DSP Debug Q8

J6 – Function – Board to Board Connection to TTY Board (6020-0310) J1

Pin 1 Ground
Pin 2 Ground
Pin 3 and Pin 4 N/C
Pin 5 TTY Power (12 VDC)
Pin 6 TTY Power (12 VDC)
Pin 7 CPU Power (3.3 VDC)
Pin 8 CPU Power (3.3 VDC)
Pin 9 Peripheral On
Pin 10 N/C
Pin 11 TTY On
Pin 12 Display Current (Spare Analog 1)
Pin 13 and Pin 14 N/C
Pin 15 /Reset
Pin 16 through Pin 18 N/C
Pin 19 Read/Write
Pin 20 MCU Clock
Pin 21 /Data Strobe
Pin 22 N/C
Pin 23 Address 0
Pin 24 Address 1
Pin 25 Address 2
Pin 26 Address 3
Pin 27 and Pin 28 N/C
Pin 29 TTY Select
Pin 30 N/C
Pin 31 Data Line 0
Pin 32 Data Line 1
Pin 33 Data Line 2
Pin 34 Data Line 3
Pin 35 Data Line 4
Pin 36 Data Line 5
Pin 37 Data Line 6
Pin 38 Data Line 7
Pin 39 Data Line 8
Pin 40 Data Line 9
Pin 41 Data Line 10
Pin 42 Data Line 11
Pin 43 Data Line 12
Pin 44 Data Line 13
Pin 45 Data Line 14
Pin 46 Data Line 15

Pin 47 and Pin 48 N/C
Pin 49 Ground
Pin 50 Ground

7-3 Antenna Connection

50-ohm Impedance Coaxial Cable to Antenna - Female TNC Connector

CHAPTER 8
Miscellaneous

8-1 Call Box Customer Service

Your call box system is designed to give you reliable, trouble-free service. However, should you experience any difficulty; Call Box Customer Service is available for you.

If after reading these instructions and the Troubleshooting section you still are unable to isolate or resolve a problem, contact Comarco Customer Service at the following number:

1 800 487-9166

Our hours are 8:00 a.m. to 5:00 p.m., Pacific Time, Monday–Friday.

Our address is:

Comarco Wireless Technologies

2 Cromwell

Irvine, CA 92618-1816

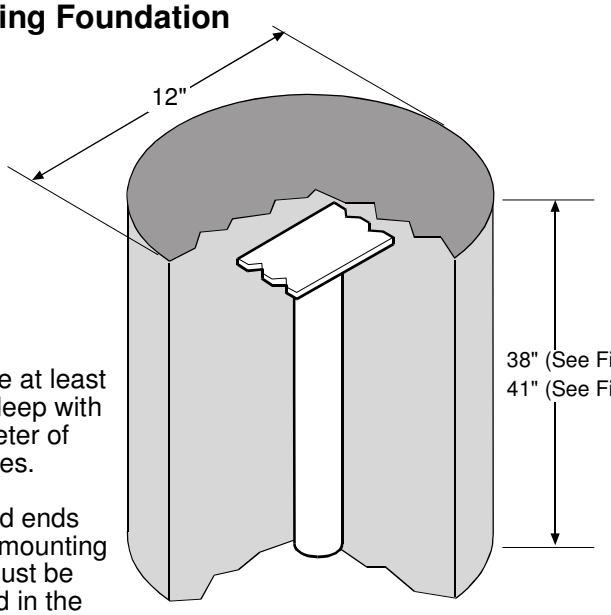
8-2 Ordering Parts for Your Call Box System

Repair parts can be ordered by calling the above "800" number. See Chapter 6 for Comarco part names and part numbers.

ADDENDUM

Cellular Call Box
Installation Instructions

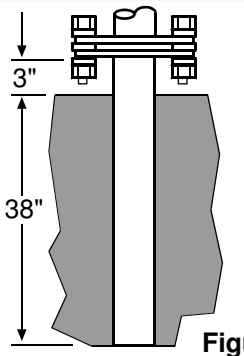
1. Installing Foundation



1a. Dig hole at least 3 feet deep with a diameter of 12 inches.

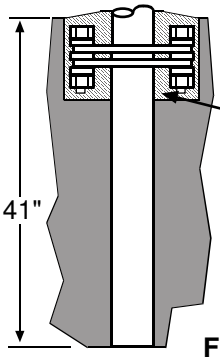
1b. Notched ends (Vs) in mounting plate must be oriented in the direction the call box will be facing.

1c. Depending where the call box is to be installed, use the diagrams at right to determine at what depth to cement the foundation.



Leave the mounting plate of foundation at least 3 inches above ground level

Figure 1.
Installation along roadsides.



Fill depression with dirt

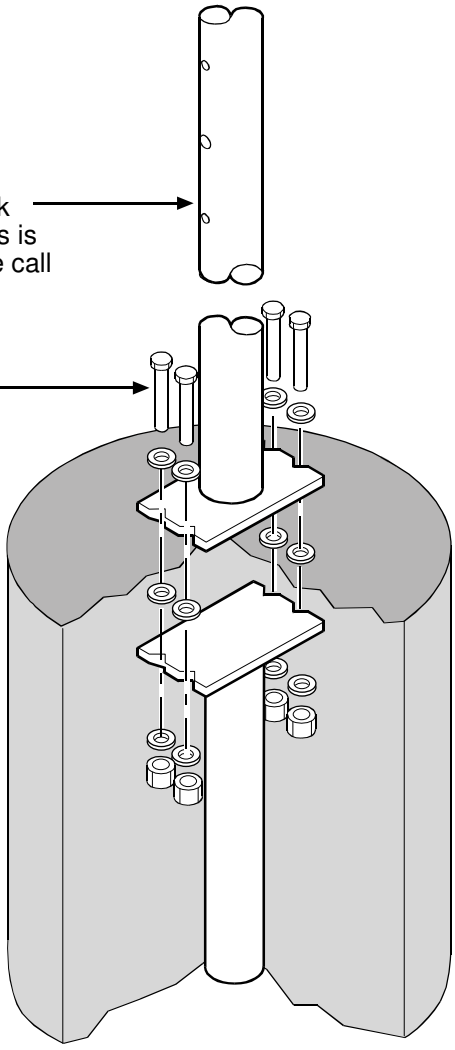
Mounting plate goes below ground level. Fill the depression around mounting bolts

Figure 2.
Installations in parks and along walkways.

2. Mounting Pole To Foundation

2a. When installing pole, check direction of the 3 holes, this is the side of the pole that the call box will be mounted.

2b. Mount pole to the foundation using the hardware supplied.



3. Attaching Bands For Sign Mounting

3a. Band the sign brackets to the pole using double wraps. (See Figures 3 and 4)

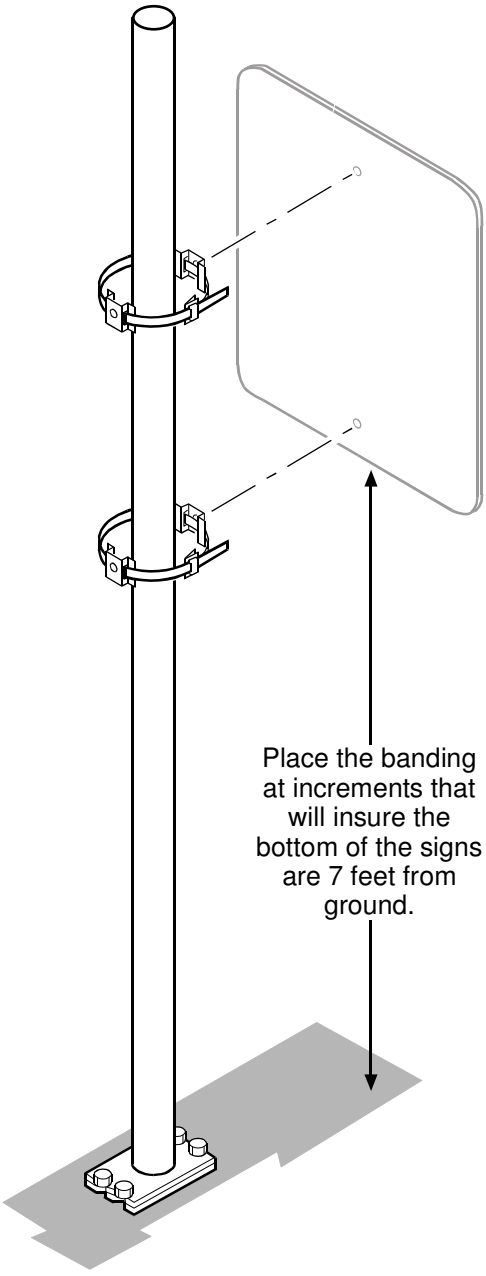
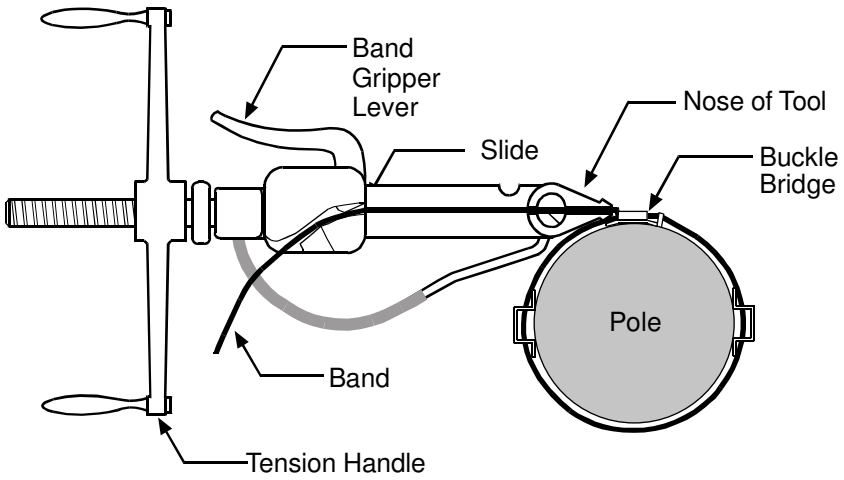


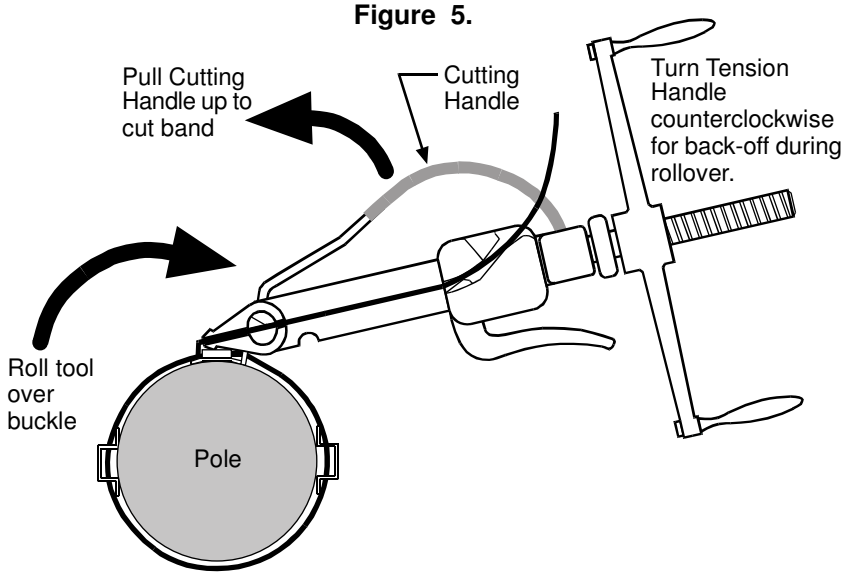
Figure 4.
Tightening bands with the Band-It Tool



Place band in open slot of tool nose and in slide. With thumb on band gripper lever, apply tension by turning handle of tool clockwise. After tension is created, it is no longer necessary to hold band gripper lever as it locks itself under tension.

Place finger on Band-It Band at buckle bridge while tensioning with tool handle. When you feel Band-It Band stop moving through buckle as you are turning handle, maximum pressure is being exerted by the Band-It Band around object being clamped. Stop turning handle.

Figure 5.

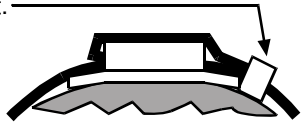

Pull Cutting Handle up to cut band
Cutting Handle
Turn Tension Handle counterclockwise for back-off during rollover.
Roll tool over buckle
Pole

Roll tool over buckle, backing off with tension handle throughout entire rolling operation. Failure to back off with tension handle throughout entire course of roll may result in breaking of band. There is no loss of tension as band released is used up in the bend.

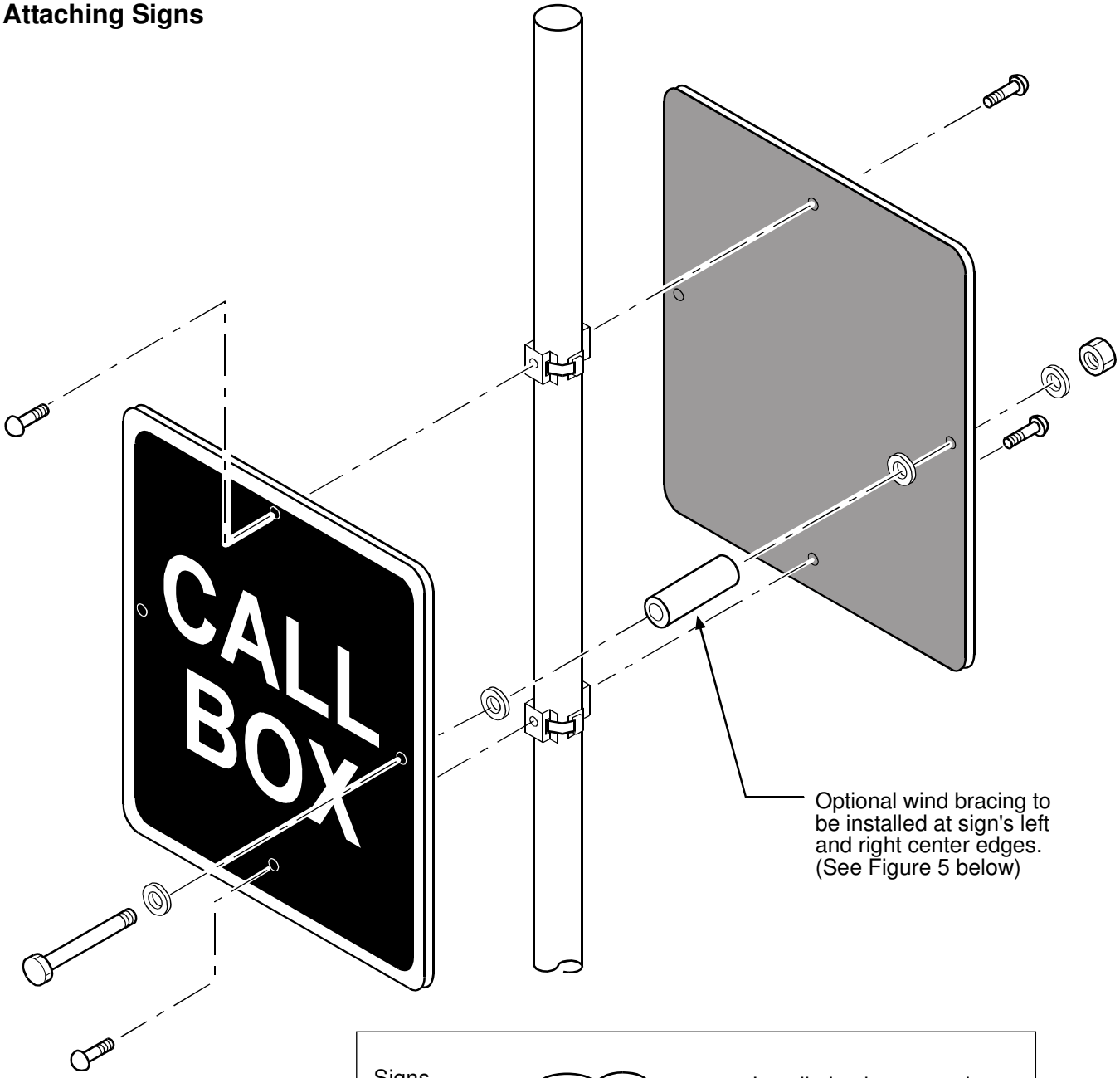
Pull up on cutting handle to cut the band.

Remove tool, holding stub of band down with thumb.

Clinch stub of band by hammering tabs down flat.



4. Attaching Signs



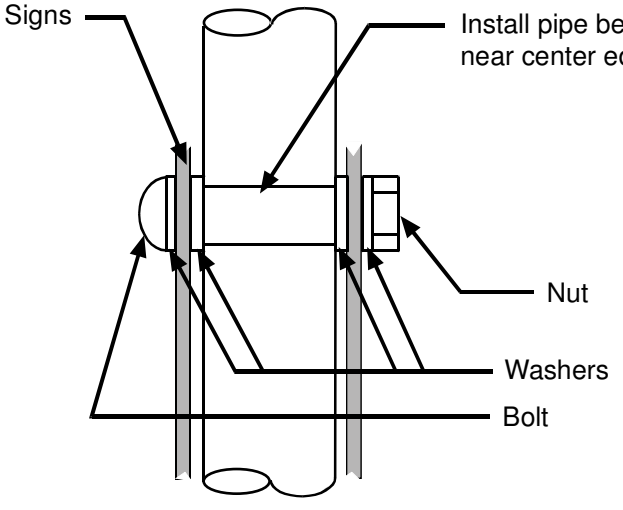
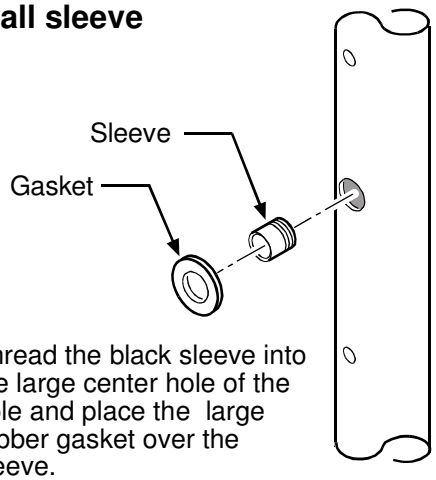


Figure 5.
Optional Wind Bracing

5. Install sleeve



5a. Thread the black sleeve into the large center hole of the pole and place the large rubber gasket over the sleeve.

6. Install cables and solar assembly

6a. Install the antenna cable and the solar cable in the pole and pass the ends out of the large center hole. Please note the connectors for proper orientation and direction.

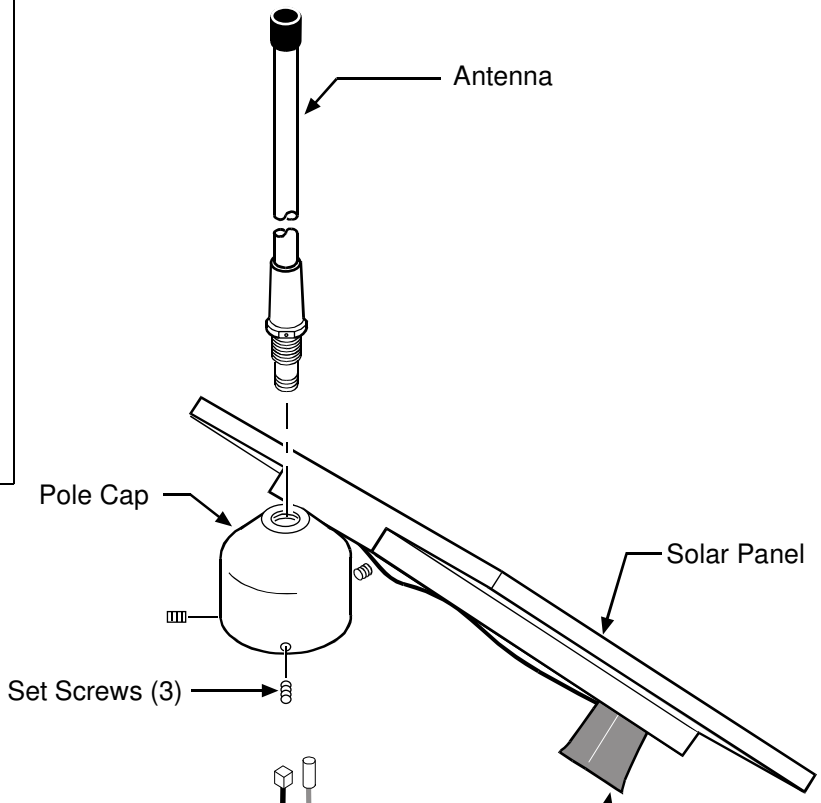
6b. Mount the call box back plate to the pole using the bolts and rubber washers with the square holes and tighten with the nuts.

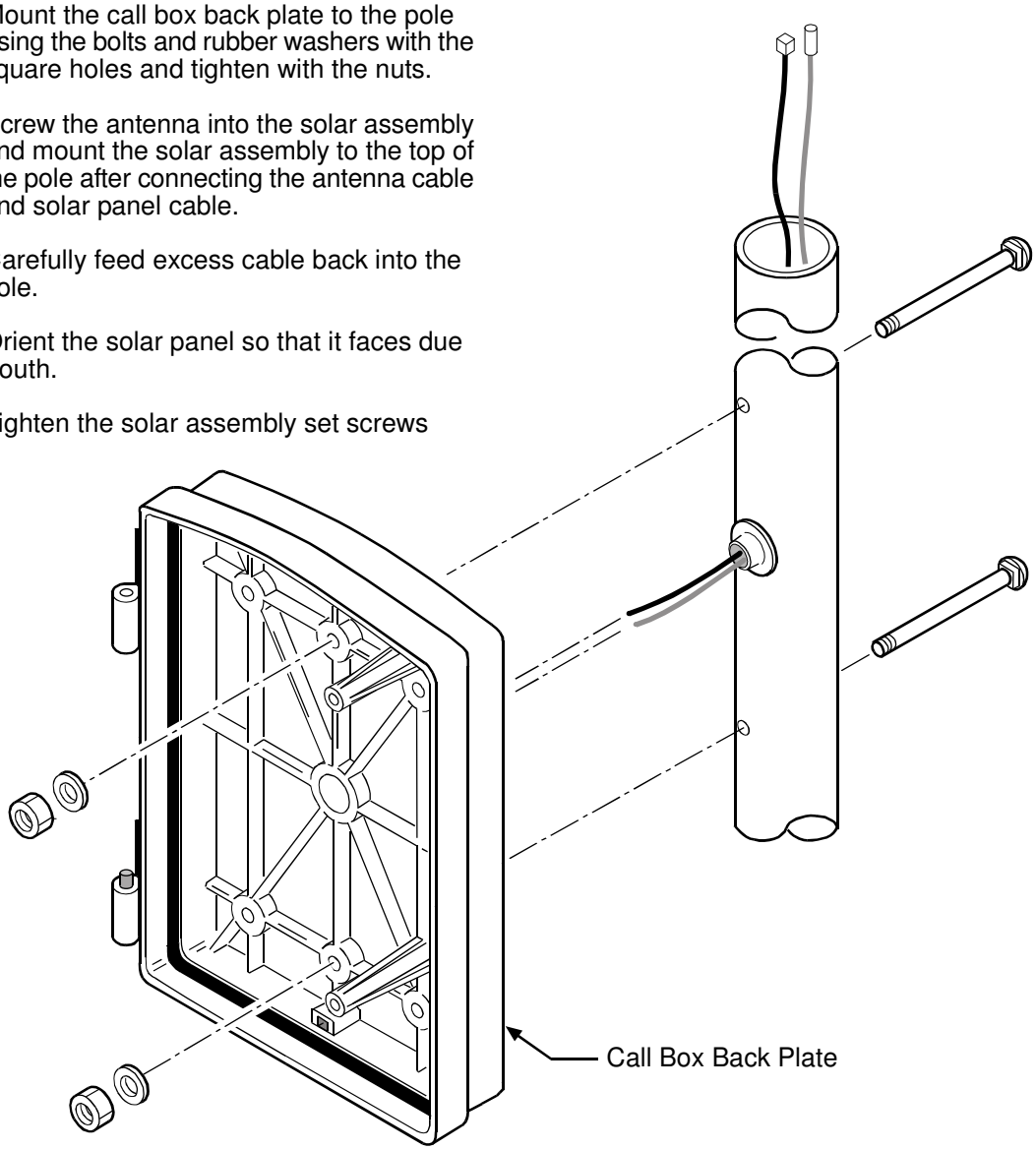
6c. Screw the antenna into the solar assembly and mount the solar assembly to the top of the pole after connecting the antenna cable and solar panel cable.

6d. Carefully feed excess cable back into the pole.

6e Orient the solar panel so that it faces due South.

6f. Tighten the solar assembly set screws





7. Mounting the Call Box and making connections.

7a. Mount the Call Box to the back plate by slipping the call box onto the back plate mounting pins.

7b. Connect the antenna cable to the transceiver connector and connect the six pin solar cable to the Call Box Input / Output board.

Note this connector is keyed and can be installed in only one direction

7c. Using the diagram to the right, turn the internal power switch to the on position.

7d. Push the excess cable back into the pole and carefully close the Call Box.

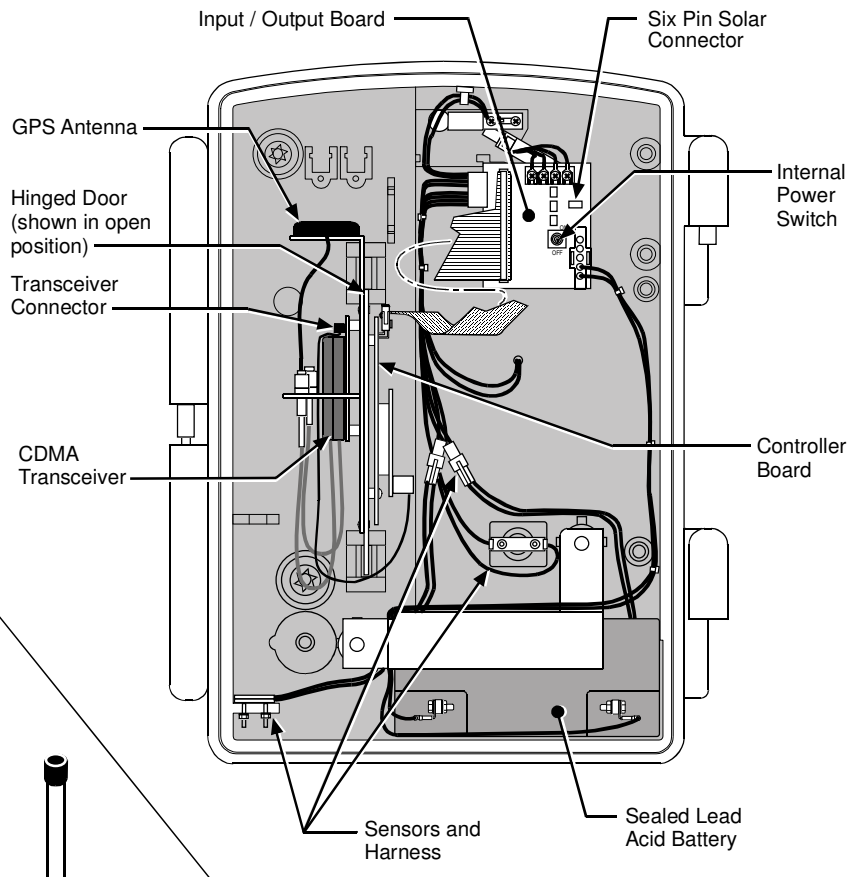
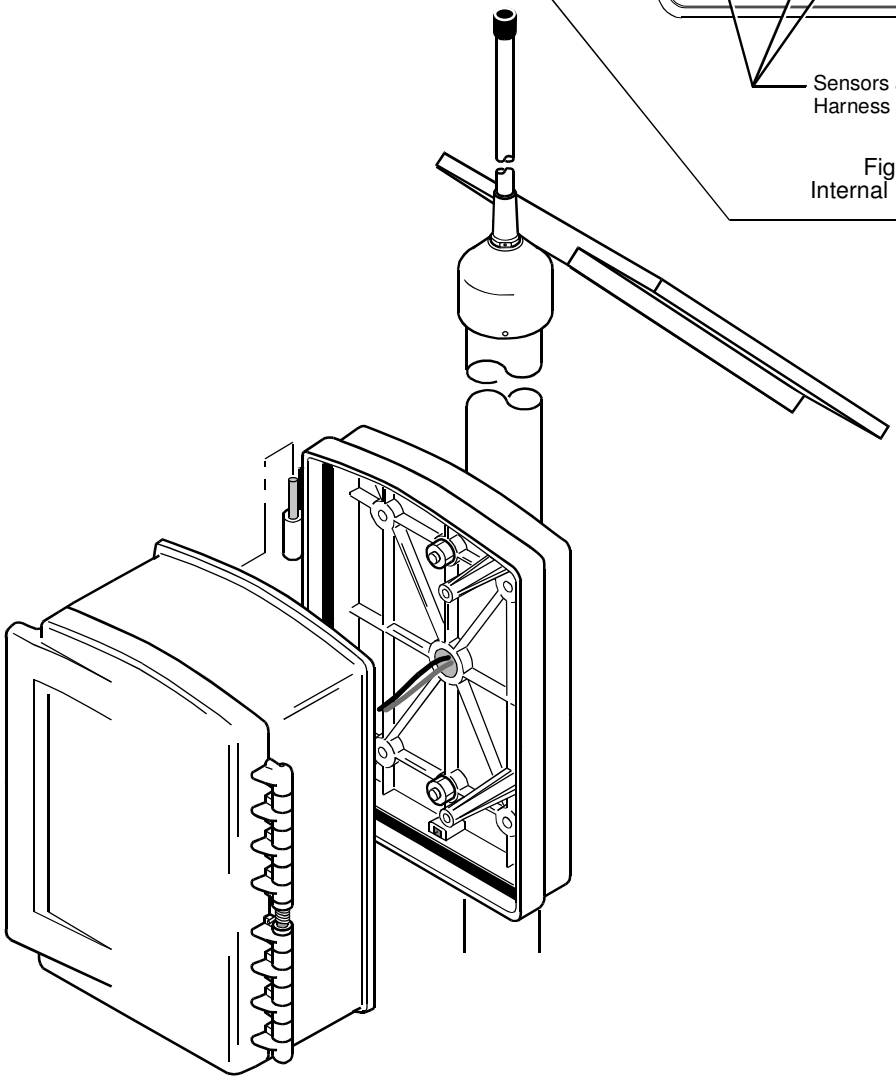
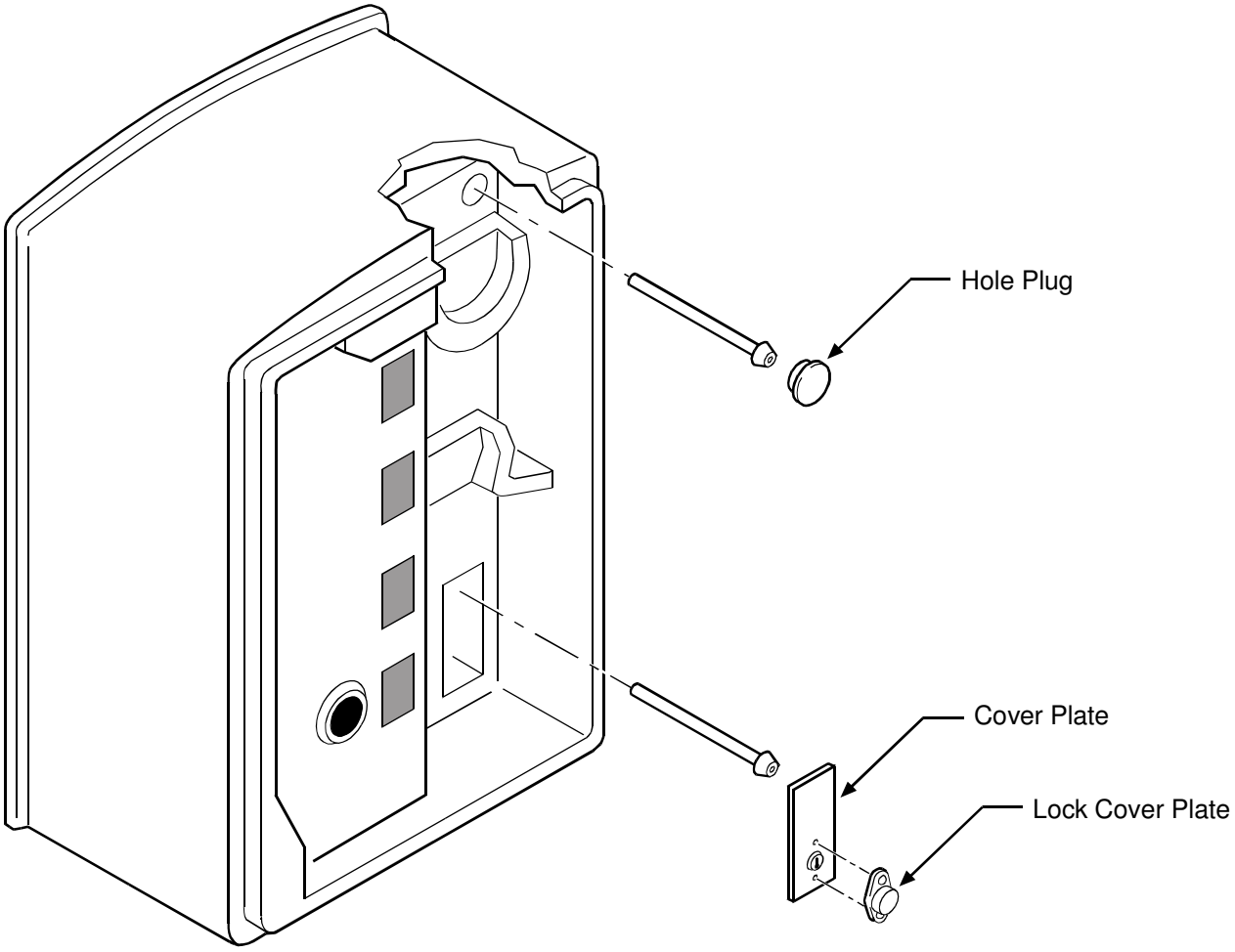


Figure 6.
Internal Electronics



8. Securing Call Box



View shown without door and handset

8a. Lock the Call Box into the closed position using the large bolts and the special tool and tips provided

8b. Lock the cover in place by using the key and turning the key continuously until the cover plate is firmly in place. When lock cover is tight, slowly turn key in opposite direction until a click is heard. The key can now be removed. Install the lock cover plate and tighten screws.

8c. Install the upper hole plug over the upper mounting bolt.

8d. The Call Box should now be tested to determine proper operation.